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The Planter assumes no responsibility for the statements and opinions expressed by contributors.

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Founded 1919

THE SOCIETY REPRESENTS the Planters of Malaysia and other territories, whose personal and professional interests it is bound to endeavour to secure and promote.

OBJECTS foremost in the Society's Memorandum of Association are:

To promote the general interests of the planting profession.

To promote the advancement and facilitate the acquisition of that knowledge which constitutes the professional qualification of planter.

To watch over, promote and protect the mutual and individual interests of its members in respect of matters pertaining to or arising from their employment in the planting profession.

To promote and maintain good feeling, co-operation and understanding between members and their employers.

ACHIEVEMENTS of the Society are a technical education scheme, the publication of authoritative works on tropical agriculture, a monthly magazine featuring original technical articles, the sponsorship of conferences and symposia on tropical crops, and the organisation of joint consultation with employers.

MEMBERSHIP of the Society is open to: —

A Those directly employed in plantation management such as estate managers, assistant managers, superintendents, supervisors and cadets, and

B Executive engineers, estate medical officers, and qualified scientific or administrative staff of estates or organisations mainly concerned with the planting industry.

Category B may include those employed in such other senior executive, administrative, professional or advisory capacities as may be deemed by the Executive Council as being equivalent thereto

Neither category shall include clerks, conductors, hospital assistants, etc.

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Editorials:

Progress in Processing

Most natural products require some degree of processing before the consumer can make use of them, and the greater the degree of sophistication in processing, the more the uses to which the natural products can be put. This fact is highly relevant to those seeking wider outlets for Malaysia's natural products. Gone are the days when natural rubber had only to be offered as bare-back bales to find a ready market; the emphasis nowadays is on greater sophistication in packaging, and tailoring the product to suit the consumer's demands. The Government's current investigations into the possibility of locally manufactured rubber-based goods is a step in the right direction. Much more can surely be made locally than boots, shoes, rubber mats and hoses, to name a few well-established local industries.

The position with regard to palm-oil processing is relatively much more backward. Little evidence has surfaced of any serious attempts to develop local processing of palm oil, and the suggestions put forward by Pramanik* in our February issue remain to be taken up. He suggested that besides oils and fats a wide range of products with good export prospects could be produced. Our Selangor Branch's recent instructive visit to the Food Technology Unit at Serdang indeed saw no evidence of any palm oil manufacturing processes in the offing, but it did see—and later taste—some delicious fruits of research in the shape of tinned fruit juices and fruit salads. It seems a pity that the work of the Unit is not more widely known or its products made more widely available. Durian powder may not be everyone's preferred substitute for the natural product, but it is apparently the ideal ingredient for ice cream of that flavour. Similarly, dried banana and pineapple rings can form the basis of a number of food processes, as well as an ideal outlet for the farmer's surplus crop. The export potential of such delicacies as sugared pineapple rings, papaya jam, chillie sauce and powder should be considerable. Why cannot some organisation do for palm oil what Serdang is doing for the long-neglected local fruits?

Malaysian Agricultural Research

We welcome the appearance of a new scientific journal under the above title, which emanates from the Faculty of Agriculture of the University of Malaya. All the authors of the first issue (published in June, 1972) are faculty members, but it is to be hoped that future volumes will encompass a wider field of research workers. The subject matter of the new Journal ranges from agronomy to pathology, food technology and economics, and each paper carries a summary in Bahasa Malaysia. Single copies (the first issue contains almost 80 pages) cost $4, and an annual subscription $8, suggesting that it is hoped to publish two issues each year.

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* A. Pramanik. (1972). Prospects for oil palm products in Malaysia. *Planter* **48**: (32–38).

As with journals of this kind the quality of the papers varies somewhat; improvements could have been made in places by more careful and consistent editing. There are a lot of printing errors scattered throughout the text, and the references are laid out in a confusing manner; future issues however will afford opportunity to improve the standard of presentation.

The Planter welcomes 'Malaysian Agricultural Research' and wishes it success. Perhaps when the new journal is firmly established both publications might exchange ideas and material to the mutual advantage of themselves, the plantation industry, and Malaysian agriculture.

One image — slightly tarnished

The fanfares and euphoria which have attended the birth of Malaysia's national airline may have tended to obscure still further some less happy aspects of Kuala Lumpur International Airport—still erroneously referred to by the press as Subang.

A letter to a local newspaper complained, with every justification, of the appalling public address system. An official reply published in the same newspaper defended the system and asserted that it was high quality stereo! Even if this were true, or necessary, it remains frequently impossible to interpret flight announcements in the echoing vault of the windowless main waiting room whose design cunningly amplifies the scream of jet aircraft taxiing on the parking apron less than a hundred yards away.

Now comes a further irritant but one which the public can do something about. A member of this Society whose job takes him frequently through Kuala Lumpur's airport, recently boarded a taxi and told the driver to take him to an hotel in Kuala Lumpur. On being asked why his meter was not working the driver replied that it had 'jammed' and that the fare would be $8, (this being nearly $2 in excess of the normal fare). Our passenger demanded to be returned to the cab rank whereupon the fare was at once reduced to its proper level.

A few days later this same member found himself in a similar position. On this occasion he observed, shortly after setting off that the meter read $2.40 and this time the excuse was that it was 'broken'. The driver then enquired what the passenger would like to pay; agreement—at the proper rate—was reached and the flag returned to the 'For Hire' position.

Had our correspondent been a tourist he would clearly have been cheated on both occasions. Full details of both incidents have been reported to the Department of Tourism and we have offered to publish their reply. It is curious that the numbers of the two taxis concerned are immediately consecutive, suggesting, not implausibly, that they are owned by the same operator.

Planter, Kuala Lumpur **48**: 242–245 (1972)

A review of the role of Acti-dione for plant disease control in Malaysia

S.C. YOONG*, C.H. KEH† & W. KAUFMANN†

SUMMARY

Cycloheximide (Acti-dione) is an antifungal antibiotic which is finding increasing usage for the control of a wide range of fungal diseases of crop plants. It has been used not only as a fungicide but also as an abscission agent for citrus and as a rodent repellent. It has the added advantage that it is comparatively safe to human beings. The chemical exhibits a localised systemic action in many plants. This paper reviews some of its uses in the control of plant diseases, and reports its potential uses against fungal diseases of rubber, oil palm, pepper and citrus in Malaysia. Cycloheximide is particularly effective against diseases caused by *Phytophthora* spp.

INTRODUCTION

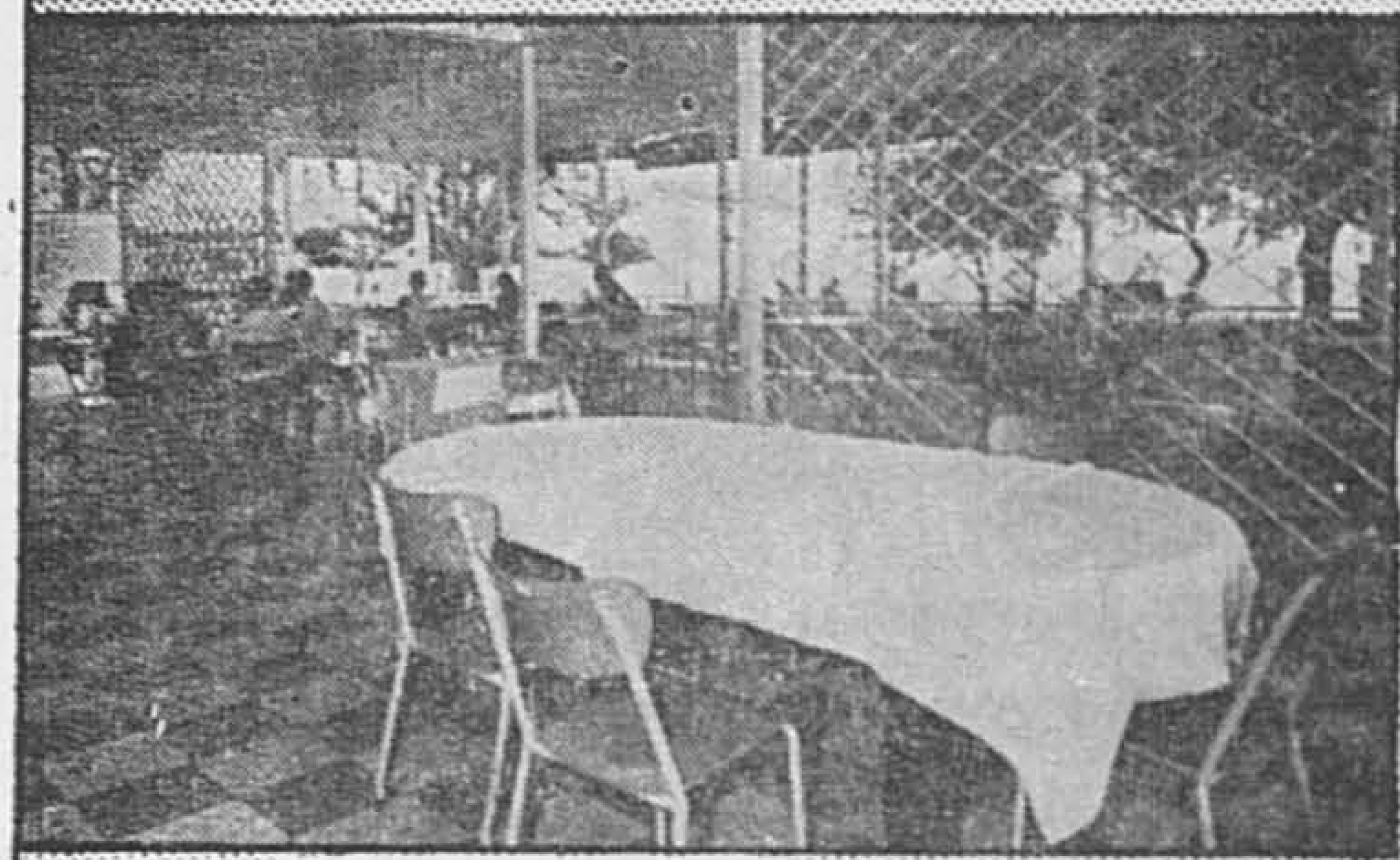
Acti-dione (cycloheximide) is an interesting antibiotic compound possessing a range of properties. It was isolated from the actinomycete *Streptomyces griseus* and its activity as an antifungal antibiotic was first reported in 1946[28]. By 1947, there was speculation that cycloheximide might control diseases of crop plants just as penicillin and streptomycin had been effectively used against human diseases. Whilst cycloheximide has not turned out to be the 'penicillin of the plant world', it has nevertheless been found to be effective in the control of certain pests and diseases of plants. Recent studies by research workers in the tropics have indicated that cycloheximide can play a useful role in several plant disease problems.

It has been reported[10] that cycloheximide is highly active against a variety of plant diseases caused by pathogenic fungi belonging to the following genera: *Colletotrichum, Sclerotinia, Sphaerotheca, Puccinia, Rhizoctonia, Helminthosporium, Curvularia, Fusarium* and *Pythium*. It was found to be active against many fungi at concentrations as low as 1–10 ppm.

Cycloheximide has been used commercially in agriculture for the past 20 years, mainly for the treatment of various fungal infections of plants such as turf diseases caused by *Helminthosporium sativum, Rhizoctonia solani, Sclerotinia homeocarp* and *Curvularia* spp.[7, 14, 17, 26], as well as damping off and root rots caused by species of *Pythium*[11, 23]; maize rust caused by *Puccinia sorghi*[16]; cucumber scab disease caused by *Cladosporium cucumerinum*[8] and cherry leaf spot caused by *Coccomyces hiemalis.*[10] Recently, it has been accepted by the USDA‡ under a temporary permit as an abscission agent for citrus.

Cycloheximide has also been used on humans against diseases such as amebiasis, as well as certain fungal diseases[1, 2, 9, 22, 29]. Although it has been used as a fungicide

* Shell Malaysia Limited, Kuala Lumpur.
† Upjohn International Inc., Kuala Lumpur.
‡ U.S. Department of Agriculture.



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Whilst human tolerance is good, cycloheximide is strangely toxic to rats (LD50 2.5 mg/kg of bodyweight) as well as to cats (LD50 4 mg/kg of bodyweight, intravenously). The possibilities of cycloheximide as a rodent repellent at very low concentrations have been demonstrated[27].

Of 4 000 compounds tested against laboratory rats, cycloheximide was found to be by far the most repellent to rodents. The rats refused to drink water containing as little as 1 ppm, even when no other water was present[24, 27].

Cycloheximide is also used in bacteriological media to facilitate the isolation or counting of bacteria in the presence of yeasts or moulds, especially in Klighter's iron agar. Accurate enumeration of bacteria is often complicated by the presence of moulds and yeasts which normally develop rapidly during incubation in the growth medium. It has been found that Kligher's iron agar containing 0.01% cycloheximide gives a good inhibition of mould growth, except for some *Aspergillus* spp. This facilitates the accurate and easy counting of bacterial colonies[15].

Cycloheximide, in contrast to most other fungicides available in the market, is not a surface-acting fungicide; rather is it absorbed into the plant tissue, showing some local systemic activity[12, 18, 19]. Its action as a fungicide is through its capability to interrupt the enzyme production within the cells of the fungus.

THE USE OF CYCLOHEXIMIDE IN TROPICAL PLANT DISEASE CONTROL

The introduction of cycloheximide for agricultural uses in Malaysia began in late 1970. However, plant protection scientists have used the compound on an experimental basis for the last 4 years, and future uses of cycloheximide have been indicated for the following crops:

RUBBER

Mouldy rot

The results obtained by the RRIM show that cycloheximide is highly effective against the disease caused by *Ceratocystis fimbriata* when applied at 0.02% active cycloheximide (*i.e.* 5 ml Acti-dione 4.2% to 1 litre of water) at weekly intervals [3, 4, 5, 20, 21], and that cycloheximide gives effective control of the disease with two applications one week apart.

Black stripe

The disease caused by *Phytophthora palmivora* is more prevalent and difficult to control than mouldy rot and other panel diseases. Chee[5] showed that among twenty fungicides tested, organo-mercurials (0.5% Antimucin WBR, 0.5% LPF XXI and 5% Kroma-clor), captafol (2% Difolatan), drazoxolon (1.0% Mil-col) and cycloheximide (0.5% Acti-dione) were effective against black stripe when applied after every tapping. In an attempt to extend the interval between applications after every tapping, Chee[6] experimented with various adjuvants and solvents. He showed that a mixture of Shell Panel Dressing or palm oil with cycloheximide (0.5% Acti-dione) could reduce the frequency of application from 2- to 4-day intervals, provided the treatment was carried out immediately after the latex had been collected.

From field experience, it is postulated that as a preventive measure 0.25% Acti-dione can be applied when field conditions favour the occurrence and development of black stripe and mouldy rot.

OIL PALM

Marasmius-*bunch-rot*

Results of recent trials have indicated that cycloheximide controls bunch rot (*Marasmius palmivorus*) of oil palm. Trials are now in progress to evaluate the optimum dosage rate.

CITRUS

Citrus root and collar disease

In recent years a fatal decline of mature citrus orchards has been of frequent occurrence in Malaysia. The causal agent is *Phytophthora nicotianae* var. *parasitica*[30]. The disease is characterised by the oozing of gummy substances from the bark of the trunk, especially in the collar region. As the disease progresses the foliage turns yellow, accompanied by twig dieback, giving a ragged appearance. Recent experiments have shown that cycloheximide (0.25%–0.5% Acti-dione) applied at intervals of 3 weeks can control the disease on trunks and branches, although gummy substances continue to ooze out 3–5 days after the initial application of cycloheximide. After this initial period, the affected parts gradually heal up.

PEPPER

Pepper foot rot

Foot rot caused by *Phytophthora palmivora* and *P. parasitica* is threatening the pepper industry in Malaysia, especially in East Malaysia[13]. Studies on the fungi carried out at the Faculty of Agriculture, University of Malaya[25] have shown that cycloheximide actively inhibits the growth of the fungi, even at low concentrations. Further work is currently in progress on the use of this compound to control the disease under field conditions.

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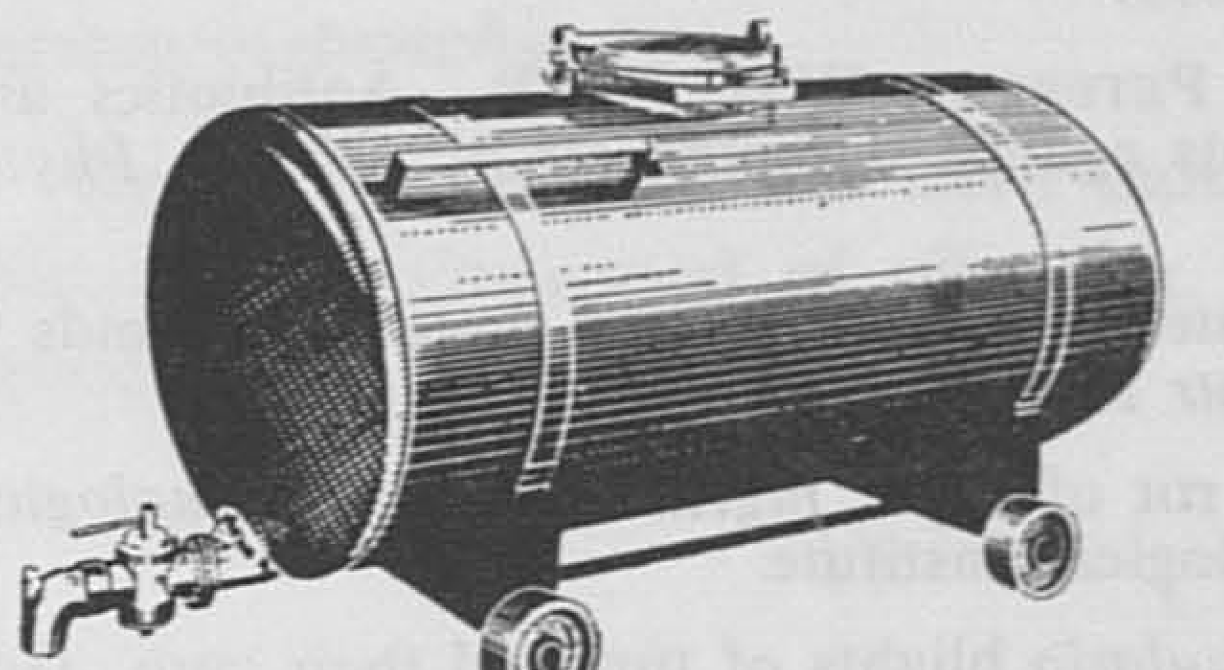

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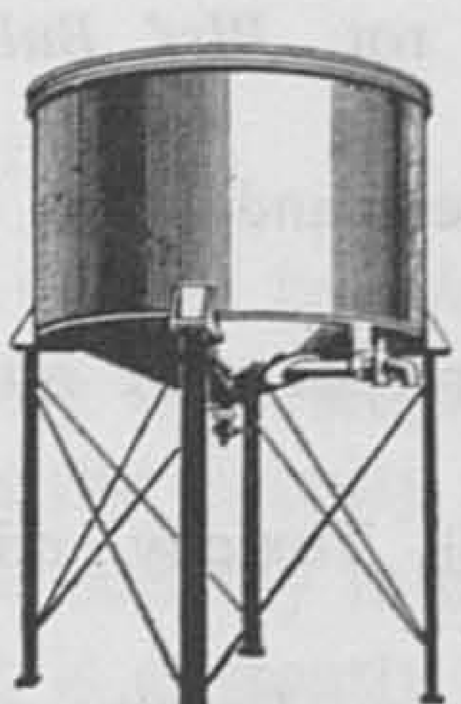

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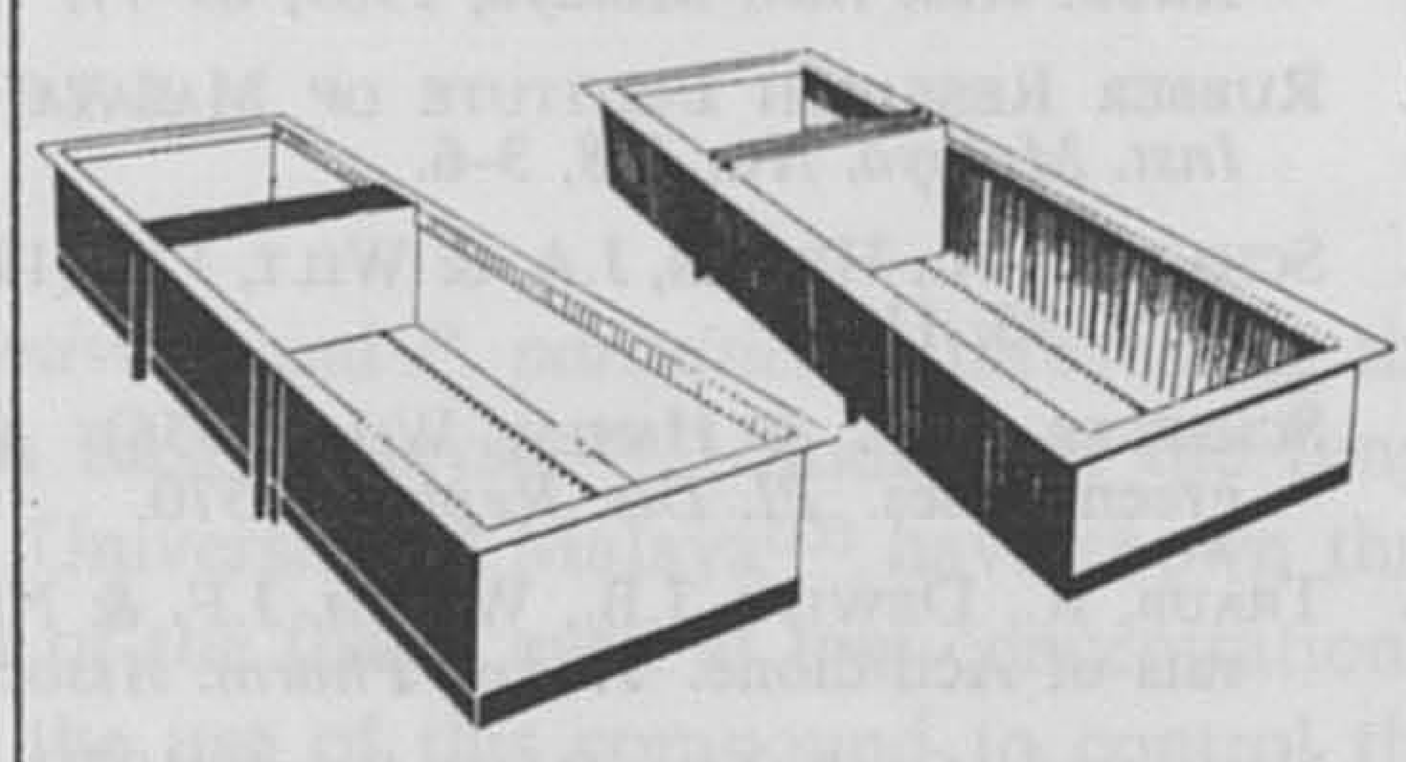

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Planter, Kuala Lumpur **48:** 246–263 (1972)

Conservation in Malaysia

P. R. Wycherley

PART THREE — AGRICULTURE (1)

The literal meaning of agriculture is to till the fields. The development of settled agriculture has been the precursor of modern civilisation. Early man gathered wild plant produce such as fruits and roots. He collected also simple animal foods, eggs, insects and honey, much as many of the wild primates (monkeys and apes) do today. Later man became a hunter and a fisherman as well as a gatherer.

Another early stage seems to have been the partial domestication of cattle, sheep and goats in herds and flocks which were grazed in natural rough pastures for their milk, meat and skins. This may have evolved from keeping animals captured alive as a living larder. Working animals including dogs may have been adopted by man in a similar way during the hunting phase. Pets may have evolved in the same way, although in more advanced cultures they may have originated from animals kept for religious purposes, divination, sacrifice or as incarnate deities.

Most of the early graziers were nomads, travelling great distances to find adequate fodder and water for their flocks. They had to travel partly because they lived in the more arid regions where natural grasslands occur and water is scarce, and partly because they kept excessively large herds as indicative of wealth and allowed these to exhaust local resources before moving on, which in turn was due to the need to concentrate the herds for protection. The natural vegetation and terrain of south-east Asia has not been suitable for the development of this phase of migrant shepherds and herdsmen, which has been poorly represented in Malaysia. In other parts of this region the grasslands left by abandonment of shifting cultivation have been grazed, but this has not been on so great a scale in south-east Asia as in Africa, where large areas were kept under grass by fire and numerous cattle.

The deliberate planting of crops for subsequent harvest as distinct from reliance on collection from self-sown wild plants was the great step towards agriculture as we know it. Some believe that the first crops were vegetatively reproduced plants such as bananas and roots or tubers, because these are most easily grown by division of existing plants. According to this view crops raised from seed came later, because the idea of saving seed and sowing it is more complicated. The saving of seed for sowing next season may have evolved from storage of seed as a reserve of food in a manner roughly parallel to the evolution of flocks from living larders. These first plantings were probably on recent alluvial deposits by rivers, or on soil exposed by windfalls, landslips or fire caused by lightning.

The next phase was to destroy the natural vegetation in order to plant crops. This required tools and the use of fire. Unless storage preceded cultivation, methods of storing seasonal crops had to be devised. A similar development was to supplement the grazing of livestock with fodder fetched from elsewhere or stored in some way especially during the adverse season in the cold or arid regions. These animals

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kept in stalls and paddocks could be slaughtered when food was scarce. The pressures towards these developments have been less in the humid tropics than in other climatic zones.

The domestication of animals by Malaysian aborigines has been limited largely to dogs, but some animals caught alive have beep kept as pets, there is even a record of aborigines keeping a pet sambur deer. Fishing has always been an important part of the Malay economy and the coconut seems to have been adapted early as a crop from the self-sown palms of the sea-shore. Malaya has been ideally situated to obtain crops from other parts of Asia, from Africa and eventually America by the successive Arab, Portuguese, Dutch and British traders, navigators, settlers and colonisers.

Shifting cultivation

One of the more primitive types of agriculture in the tropics, shifting cultivation, is still practiced by aborigines in Malaya and by other indigenous peoples in East Malaysia. Although there are archaeological indications from different parts of the world and many current anthropological observations that shifting cultivation has been widespread throughout the tropics from the Stone Age onwards, it is largely conjecture as to what extent the methods have changed.

It is often assumed that the way of life of the aborigines has remained unaltered until the impact of the twentieth century, whose penetration by such agencies as the transistor radio can be traced and assessed. However, there is evidence that the Temiar of North Malaya did not begin to acquire hill padi from the Malays until as recently as 60 years ago before any disturbances from technicological civilisation reached them. Previously millet (*Setaria italica*) was the main cereal crop of the Temiar and still is in their more remote clearings. Millet has been cultivated in east Asia for at least 4 500 years. *Sorghum vulgare* of Old World—probably African—origin is grown by aborigines to a limited extent; it is uncertain when it first reached them. The Temiar grow chillies, tapioca and maize also; they seem to have adopted these crops before accepting padi. They can only have acquired these three crops during the last 400 years because these plants are American in origin and were unknown in the Old World until Columbus discovered the New. Thus, if for no other reason than the acquisition of new crops, we know that there have been some changes, but when, their magnitude and rate are difficult to judge.

Temiar millet system

Probably the shifting cultivation based on millet as the main crop practised by the more isolated Temiar is typical of the ancient methods of many of the aboriginal peoples in the region. The Temiar hunt and fish also, which provides most of the protein in their diet. The people of the family or clan group living in each longhouse or village fell an area of nearby primary or old secondary forest and burn the trash. On sloping land simple terraces are sometimes made by lining the larger partially burnt logs along the contours, so that some of the silt and ash collects above them as seed beds. The millet is planted in holes dibbled with a pointed stick and usually only one crop is taken. Afterwards the area is abandoned to invading secondary forest; or perhaps bananas, whose wild relatives are secondary jungle species, are planted to give one crop which is not very carefully weeded until the forest is allowed to take over. Other vegetables are grown near their dwellings and the occasional fruits of the jungle are gathered on hunting trips.

The abandonment to secondary forest is the equivalent of turning a field over to fallow. It is allowing a period during which the soil fertility is restored by a covering of forest, even if it is secondary forest different from the primary jungle, soil reserves are not severely depleted, the invasion of tree species is rapid, and as but no crops are sown, grown or harvested. If only one crop of millet is taken, the soil reserves are not severely depleted, the invasion of tree species is rapid, and as far as it is possible to judge, fertility is completely restored in a period perhaps as short as 10 years, when the cycle may be repeated.

While the human population density is low, it is possible for an adequate number of clearings or fields, each with its long fallow relative to the cropping period, to be used in turn in the district surrounding the settlement, without any serious deterioration in the soil. However, sometimes soil fertility does become noticeably less and the aborigines move, perhaps only a few miles, and set up in a new area, but by the time they need to move again, the longer fallow has probably restored the soil at the first location. The result is a matrix of undisturbed virgin forest with many islands in all stages of felling, cultivation and fallow. The cultivation is shifting in the sense that it moves from field to field and occasionally the village centre moves too, but from generation to generation the same tribal lands are occupied, the soil fertility and the forest hunting reserves are maintained. The preservation of ancient varieties of only partially domesticated crop plots, such as unselected millet and bananas, is a useful service to plant breeding.

Severer systems

When the Temiar adopted dry padi, they often grew two crops instead of only the one usual with millet. Planting up the more thoroughly cleaned and weeded land afterwards with tapioca, which is a demanding crop unless heavily fertilised, continues the process of soil exhaustion. The result is a strong tendency for the grass *lallang* (*Imperata cylindrica*) or at higher elevations bamboos (*Gigantochloa*, etc.) to take over and to prevent forest regeneration indefinitely when the clearing is abandoned. Soil fertility deteriorates under *lallang* and does not seem to be restored under bamboo, a thicket of which is very difficult to clear in any case. Fires in *lallang* or bamboo retard further forest regeneration and encourage leaching of nutrients from the soil.

The use of the hoe, or *changkol* as it is known locally, in place of the dibble stick may cause more soil disturbance and hence more erosion on sloping land. Irrespective of this, the main factors in turning the course of regeneration from secondary forest to grass or bamboo after abandonment to fallow, are the increase in the period of cultivation and the decrease in the duration of the preceding fallow.

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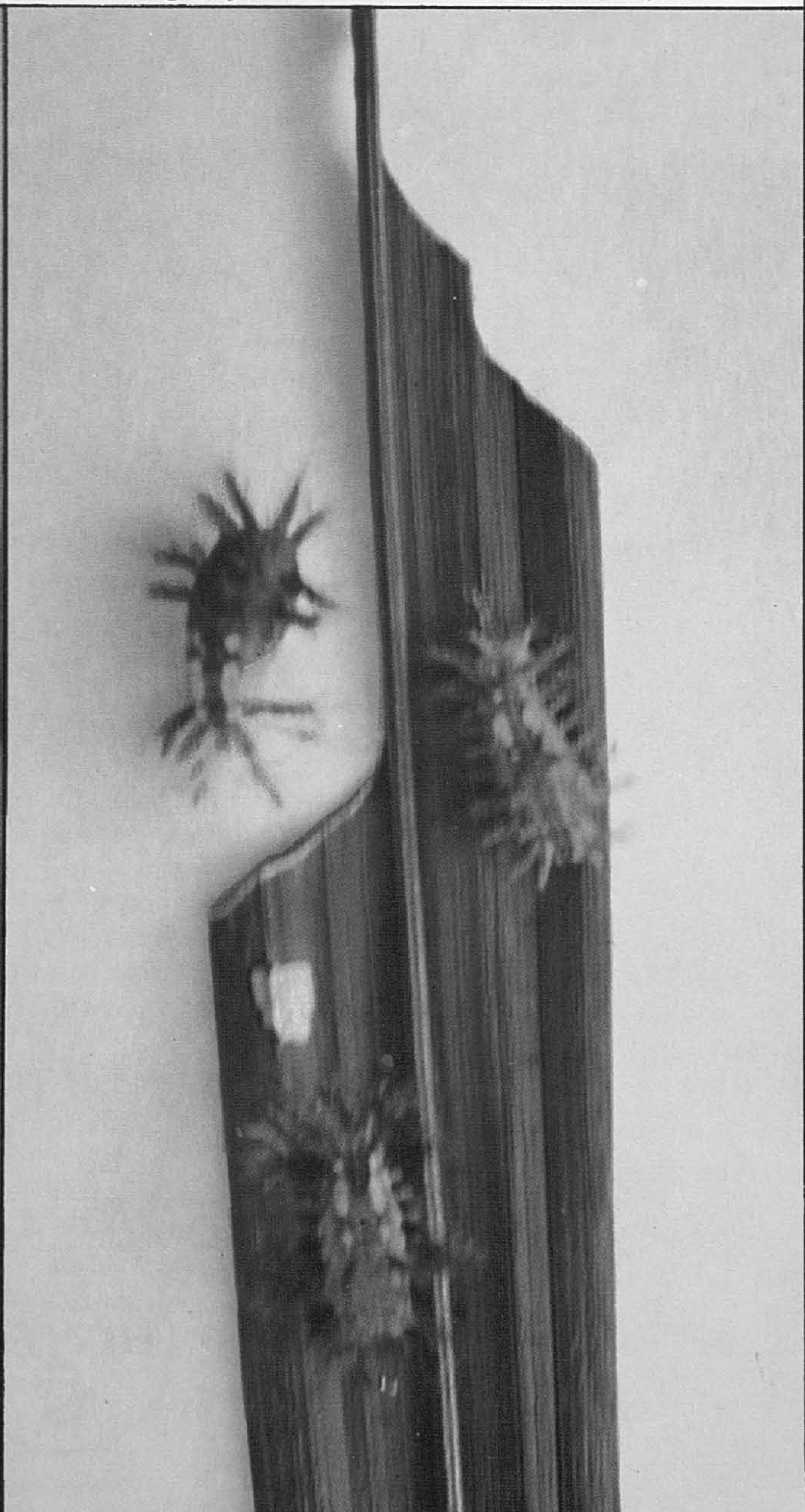
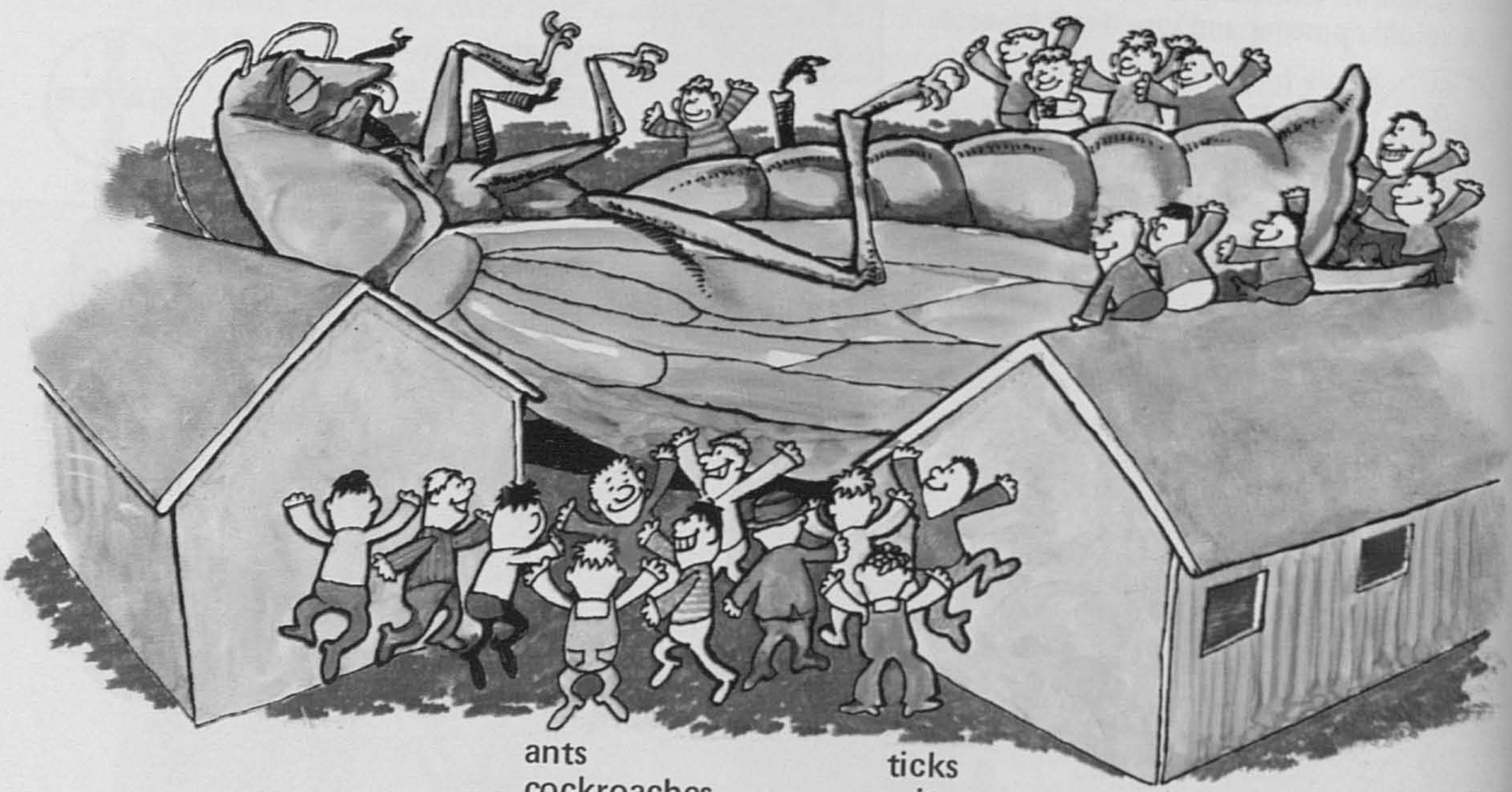


The end of the line for these pests



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Other undesirable features, which usually occur in conjunction with those already mentioned, are the clearing of steeper slopes and of contiguous clearings with inadequate adjacent forest to assist in regeneration or to provide boundary belts to check the spread of fire or massive sheet and gulley erosion. Various influences cause these changes leading to permanent destruction of the forest and its replacement by undesirable 'biotic' or 'fire' climax vegetation, soil erosion and loss of fertility, unless made good by the use of fertilisers and the methods of settled agriculture.

Usually these pressures and changes are blamed on increasing population density, whether this is due to squatters invading an area or to natural increase (population explosion), the resultant land shortage causes cultivation to continue too long with inadequate fallow in adjacent clearings. However, other reasons should not be forgotten. Resistance to shifting when necessary may arise, because one centre is well situated for access by traders, who purchase jungle produce for each which enables the aborigines to buy sophisticated tools, firearms and radios, and by various official agencies bringing education, medical facilities and social welfare. These outside contacts may be very attractive and break up the traditional pattern with its respect for the tribal forest heritage. Eventually the system may be reduced to one of the thoughtless over-exploitation as practiced by many who had no stake in the country in the past.

Chinese gambier system

This is an example of one of the crudest and most devastating forms of shifting cultivation. *Uncaria gambir* is a shrubby climber of the Coffee family, whose fresh leaves, when boiled, yield gambier used in the dyeing and tanning industry. During the first half of the nineteenth century it was planted extensively in Singapore and later in South Johore by the Chinese. The method was to crop each clearing exhaustively first with gambier and then with tapioca until it yielded too little to be worth harvesting, *lallang* almost invariably invading afterwards. The depredations of the nearby forest for firewood to boil the gambier were equally severe. As each area was ruined, the cultivators moved on further to repeat the process. Often they had no title to the land and certainly made no efforts to restore it. The sole object was the maximum profit for the minimum outlay. The effect of this on the soil in these areas has been long felt.

A similar situation arose in some areas occupied by squatters during the Second World War for the cultivation of subsistence food crops. The lack of fertilisers largely forced them into this irresponsible treatment of the land, accentuated by the knowledge that they had no title to the land, which was neither their heritage nor to be patrimony of their children.

These extreme examples should not lead to condemnation of all shifting cultivation. Nevertheless the pressures on the benign primitive system are increasing and it is doubtful if it can survive long. In some cases settled agriculture must be introduced immediately, especially where shifting cultivation is not the traditional life of the people. In others the shifting cultivators may survive with varying degrees

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of success for a few generations more, until probably sooner rather than later, the essential forest fallow cannot be secured, and the land will have to be rehabilitated from *lallang* or bamboo for settled agriculture or for productive or protective forestry, perhaps at great national expense.

Where the aboriginal shifting cultivators find themselves alongside land development schemes, successfully using the methods of settled agriculture, the aborigines may copy these methods, much as they have borrowed crops in the past, and settle down to make the best use of their lands under the changed conditions of population pressure. Wise advisers may assist them to do this without complete disruption of their social system and culture. Government planners may reserve the rights to hunt and fish by their traditional methods in adjacent forest to the aborigines. The fatal susceptibility of the aborigines to diseases such as measles, chicken pox and mumps, which are regarded as normal childhood complaints among the town dwelling races, and other social factors make the adjustment of the aborigines' way of life to the modern world very difficult. Equally to try to preserve them as fossil cultures in distant reservations may deny them self-determination, political development, education and material advantages, which are regarded by many as the rights of man. Who shall decide to what intellectual and physical benefits and risks any others shall be exposed to or preserved from contact? Conservation of natural resources brings conflict with the aspirations of people, whether it be the hungry majority in the world or the cultural minorities.

Settled agriculture and civilisation

Civilisation is derived from a word meaning to do with cities. Whatever we mean by civilisation, for instance government by law, political and social development, the practice of the arts and sciences, the communication of ideas or even the waging of modern warfare, has required fixed centres. In these people can congregate, facilities such as machinery and records can accumulate, and at least some of the people are not totally occupied in food collection or cultivation so that they have time to invent new things and pass on this information by education of their children and neighbours.

The villages of the gatherers, hunters and fisherfolk could be fixed in location, but these occupations were so time-consuming that little was left over for progress towards civilisation. Also since they could easily exhaust food supplies within a convenient distance from their village, there were limits to the size of the villages sustained in these ways.

The nomadic graziers undoubtedly had more time for spiritual and cultural contemplation with the consequent emergence of religious thinkers, poets, musicians using simple instruments, and story tellers. However, their constant movement virtually limited the records they could carry to oral tradition; similarly advances in building or mechanical aids were either impossible or greatly hampered. It has been argued that these cultures before civilisation were better adapted to their environment than those since, but for the vast majority of the world's population there is no way to return.

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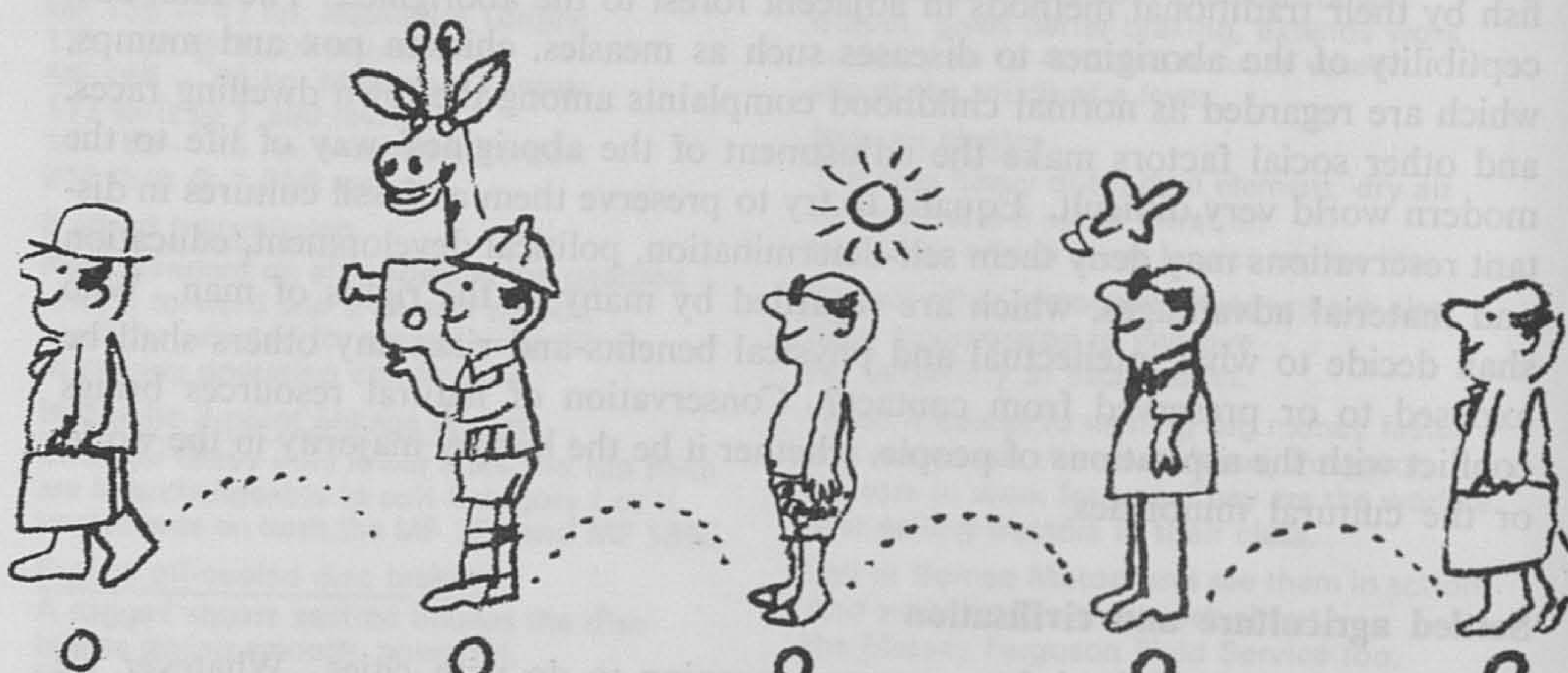

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Shifting cultivation in the more fertile areas may have sustained some centres of civilisation, especially where a military caste or a religious priesthood could command as tribute any excess produced by the surrounding cultivators. The Egyptian civilisation was supported by the seasonal agriculture of the Nile delta based on the annual flooding and deposition of alluvial silt, but this was not shifting cultivation in the sense used here. Eventually the modern civilisations of the temperate and mediterranean regions were the product of settled agriculture spurred on by the need to provide for the adverse cold or dry seasons.

The development of settled agriculture has a long history and many variations in different parts of the world, which cannot be recounted here. Settled agriculture is the source of most human food today and thus is still the mainspring as well as the origin of civilisation as we know it. In as far as a conservationist is an advanced or civilised person, he is the product of agriculture and dependent on it. Efficiency in agriculture is essential to feed the hungry millions of humanity in the world today, especially if there is to be any room left over for nature conservation.

Efficient agriculture is a process of continual use and renewal of natural resources, it is conservation in its highest form. Agriculture and nature conservation are interdependent at every level, not only in the obvious need to manage the soil and water resources wisely, but in various ecological relationships.

Human needs

Agriculture gave us civilisation, but disease limited human population until civilisation produced medicine, public hygiene and sanitation. The result of the latter has been the well known population explosion. Soon (perhaps already) there may be alive on Earth more people than have ever lived to reach maturity and died in the past. This increase in human population has created a colossal demand for food. More than half the people in the world are hungry and under-nourished. All food comes from use of natural resources and most of the extra food required must come from agriculture. Adequate food supply may help to relieve tensions between nations jealous of each other's natural resources.

Admittedly bad distribution of the world's present food production aggravates this problem. The world has been close to meeting its total food requirements in recent years, but bad distribution has made the rich countries richer and the poor nations poorer keeping many ill-fed. The increasing population makes ever greater demands. Unless the increase in world population is arrested, the problem will never be solved except by the collapse of humanity owing to famine, pestilence or self-extermination by war.

Agricultural food production can be increased in two ways. Firstly expansion of the area cultivated, which means the destruction of more natural vegetation in most cases, although land reclamation and in particular rehabilitation of abandoned areas should not be forgotten. Secondly improving the efficiency of agriculture which has been achieved by breeding and selection of more productive plants and animals, by the use of fertilisers and by the control of pests, diseases and weeds.

The pesticide revolution

Approximately the last 30 years have seen a major revolution in the control of the destroyers of or competitors with crops by means of powerful synthetic chemicals. Moreover insecticides are widely used not only for agricultural purposes, but to eradicate the vectors of human disease, *e.g.* malarial mosquitoes. All of these chemicals kill something and present hazards to their users, the consumers of the crops and to wildlife. Man, his animals and the natural environment are all in some measure at risk. Incorrect use of dangerous chemicals may poison food and defeat the object of increased production, but there are more subtle ways in which pesticides may make agricultural efficiency more difficult to achieve in future.

Whether wildlife is directly threatened by destruction of the natural habitat for agricultural alienation or is indirectly endangered by the effects of chemical usage spreading beyond the area of application and persisting for long periods, our civilisation is also susceptible to damage. Firstly because the wild flora and fauna are the genetic reserves for improvements in agriculture by breeding and selection of higher yielding and disease resistant plants and animals. Without wildlife these benefits may be curtailed in future. Secondly the chemicals sometimes cease to be effective owing to the appearance and multiplication of resistant pests when recourse must be made to biological control, for which wildlife again provides the reservoir.

Naturally occurring chemicals, especially in plants and micro-organisms, are employed as drugs, antibiotics, insecticides, and as industrial raw materials such as rubber or as the pattern for chemists seeking synthetic substitutes. We cannot afford to lose what may be the patterns for many valuable chemicals as yet undiscovered. Several important enzymatic processes depend on micro-organisms, for example the conversion of carbohydrates and inorganic nitrogen to protein by *Torula* yeasts, which has recently attracted attention for its potential in reducing protein deficiency, which is the greatest growing need in man's diet on a world scale. There are more to be discovered if an adequate range of natural habitats is preserved, in which genetic diversity is not only maintained but continues to evolve.

The revolution in pesticides and alternative methods of controlling pests have stimulated great interest in recent years as the effects of the new agents to kill weeds, disease organisms, insects and rodents have become better known. Some examples of each will be considered.

Aboricides

These are the tree-killers used in both forestry and plantation agriculture. Trees of no commercial value are poisoned in forests regenerating after extraction of timber to leave more space for the growth of the valuable timber species, and so to improve progressively the value of productive forest. This treatment of regenerating forest has been criticised, because quite often the first trees to fill the gaps caused by poisoning are not the most desirable timber trees of the primary forest but species typical of secondary growth. Thus the poisoning treatment may defeat its intended purpose. However, these methods have not yet been tried out for a sufficiently long time to discover whether or not the proportion of favoured timber species is increased in the final stocking of emergent trees, which eventually over-grow the secondary species; further it is not known if treatment extends or curtails the period of temporary domination by secondary species. Experiments in forestry must continue for a whole regeneration cycle, which is longer than a man's working life. Also it is necessary to maintain virgin jungle reserves untouched, neither felled nor treated, as controls to enable future generations of foresters to compare the results of treatment with the original forest, which is so complex in the tropics that no description would be adequate. The oldest treated areas should also be conserved, because these are the most informative experiments for the long-term planning of natural regeneration forestry methods and for basic studies of productivity.

Sodium arsenite is still the most commonly used tree-killer in forestry. Its salty taste is much liked by many animals, especially large herbivores which commonly use naturally occurring salt licks. Elephants have been fatally poisoned and died in agony from consuming sodium arsenite carelessly disposed of in the forest. Even burying empty tins containing residues is not always enough to prevent wild animals obtaining the sodium arsenite, which is so attractive to them. 2,4,5-T, widely used to kill old rubber trees in Malaysia, is not a satisfactory poison for jungle trees. Nevertheless it is hoped that continued trials will find an alternative to sodium arsenite of lower toxicity to mammals, both wild animals and the human labourers who apply it, perhaps one of those mentioned below for rubber.

Replanting

When replanting rubber plantations the old trees must be destroyed and new trees (or palms) replanted in their place. One way of getting rid of the old trees is simply to poison them and leave them to rot and fall down. This is relatively cheap and needs little capital outlay in equipment. The organic matter of the old trees (equivalent to the amount of timber produced in 5 years at the maximum rate of growth) remains on the site to enrich the soil. Better growth of the following crop has been demonstrated in some experiments where the old timber has been left on site instead of being burnt or carried away for fuel. However, if the old trees are just left to fall down, considerable damage is done to the young new plants and there is risk of injury to people working in the area. Therefore it is necessary to fell the poisoned trees while it is still safe to do so and push them over between the rows of young plants. Thus the cost of felling is re-introduced as well as the inconvenience of less easy operation in the field due to the piles of debris between the rows. Tree-poisoning might have been abandoned, but it was discovered meanwhile that the incidence of root diseases in the new stand of trees is reduced by poisoning the old trees or their stumps, the latter being somewhat less effective.

The root diseases of rubber trees are caused by parasitic fungi which encircle the roots and stem base of the trees and cut off the vascular supply between root and shoot, so killing the tree. These fungi are able to live as saprophytes, that is on the material of dead plants, as well as being parasites of living trees. Poisoning and killing the old tree does not kill the fungal parasites or prevent them from living as saprophytes on the old stump. Killing the old stump does allow it to be invaded by many more fungi which are true or obligate saprophytes only able to live on


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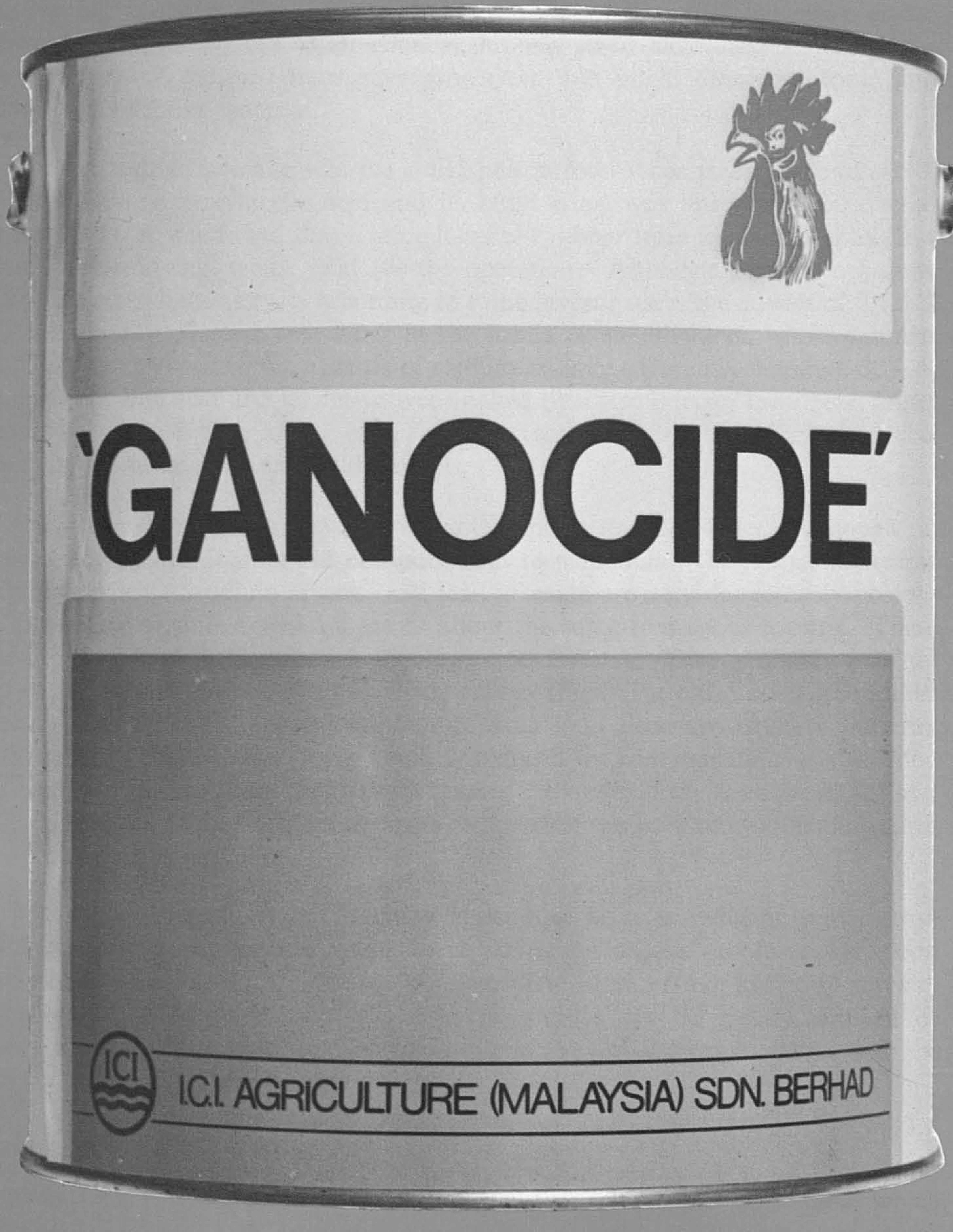

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dead material, but unable to infect living tissues, which are the preserve of the parasites. These invading saprophytes compete with the root disease parasites, so that the latter do not expand to occupy the whole stump. These saprophytes and some boring insects unable to attack healthy trees speed the rotting away of the stumps, so that the sources of infection in the new stand have disappeared by the time the roots of the new trees have grown out and might otherwise come into contact with infective material.

Earlier, sodium arsenite was the usual poison for rubber trees. When 2,4,5-T (2,4,5-trichloro-phenoxy-acetic acid and its butyl ester) was introduced as a weed and tree killer, it was found that it stimulated old rubber trees to give an extra flow of latex before dying, which paid for the operation. Although perhaps not quite so effective as sodium arsenite according to some investigators, the advent of 2,4,5-T put a reasonably effective tree killer in the hands of smallholders, whose families should not be exposed to the hazards of sodium arsenite. Recently 4-amino, 3, 5, 6-trichloro-picolinic acid and its derivatives applied by a tree injector have been found to combine very effective killing of old rubber trees with very low toxicity and risk to humans, domesticated and wild animals.

Cacodylic (dimethylarsinic) acid is another promising tree killer. Although an arsenical compound, it is almost non-poisonous to mammals. The inorganic arsenic compounds such as sodium arsenite and lead arsenate are very dangerously poisonous, but many organic arsenicals are of about the same toxicity as aspirin. These are worthy of trial in plantation agriculture and forestry. They probably will not have any yield stimulatory effect on dying rubber trees. They and other tree killers have a possible use of growing importance even if of little consequence hitherto. The value of rubber timber for pulping is reduced by contamination of the wood with latex flowing out from the bark on cutting the trees. If the trees are killed first no latex flows on felling. This may make removed of the bark more difficult, unless the operations are well timed.

The use of tree killers in plantation agriculture helps in reducing root disease incidence, enables the organic matter to be conserved on site or old rubber wood to be removed in a form suitable for pulping. The value of tree killing in forestry is perhaps open to debate, but the risks to wildlife can be greatly reduced or eliminated by finding effective, less toxic alternatives to sodium arsenite, and the prospects of finding these are good.

Herbicides

Weeds are plants growing where they are not wanted, in particular those which by doing so compete with crop plants and reduce the yield of the latter, or in the case of plantation tree and palm crops slow down their growth and delay the time of harvest. A wide range of plants may be classified as weeds, including herbs, shrubs and trees. The name 'herbicide' suggests that only soft or herbaceous weeds are the target, but the difference between arboricides and herbicides is more in the mode of application. Arboricides are applied to individual trees, whereas herbicides are sprayed over vegetation to kill both herbs and shrubs. 2,4,5-T for example is


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used in different formulations as both an arboricide and a herbicide. Weedicide and weed-killer are alternative names for herbicide.

Sodium arsenite has been used as a general purpose weedkiller for over 60 years in Malaya. Its use has been restricted by law to places where there are safe storage facilities, the labour are regularly medically examined and the areas sprayed are indicated by danger notices. Despite these and other requirements concerning containers and admixture of a dye, there have been cases of accidental poisoning (not always fatal) of humans and many cattle have died after eating sprayed herbage, whose flavour is attractive to them. A ban on the use of sodium arsenite for weed killing throughout Malaysia was proposed but postponed repeatedly.

The main advantages of sodium arsenite are its cheapness and that it kills the green parts of most plants on contact. Some plants, especially the beneficial creeping legumes sown as cover plants are very sensitive to sodium arsenite spray including accidental drift. Other plants, especially the coarse grasses and ferns, have to be sprayed repeatedly to destroy the green parts several times before the storage organs are exhausted and the plants are finally killed. Thus the use of sodium arsenite was self-perpetuating in that some less desirable types of ground cover became better established than those wanted but suppressed.

Hormone weedkillers

The hormone or auxin type herbicides, so called because the active ingredients are synthetic plant growth substances, for example 2,4-D (2,4 dichloro-phenixy-acetic acid) and 2,4,5-T, are very selective in their action, killing most dicotyledons (broad-leaved plants) leaving grasses and many other monocotyledons hardly affected. Thus if used alone, the suppression of legumes and dominance of coarse grasses among ground covers is even more pronounced with these than with sodium arsenite. Many cultural practices and natural hazards such as fire encourage coarse grasses, whose control has been the object of widespread research.

During recent years new herbicides or new formulations or methods of applying existing weed killers have been sought with the following objects in view. Firstly to provide a general purpose herbicide as cheap as sodium arsenite but less hazardous, this has now been practically achieved. Secondly to provide a range of herbicide with specific selective properties, for instance to eradicate coarse grasses with less effect on legumes or to eliminate individual broad-leaved weeds such as *Mikania* from among leguminous covers. Sometimes another weed or population of weeds different from those there before arises in the place of weeds sprayed out. A sequence of different herbicides appropriate to the weed population obtaining at each stage of the cycle may be necessary. This is not necessarily undesirable so long as the problem is recognised, otherwise there may be great wastage on repeating applications which are no longer suitable for the changed conditions, meanwhile some weeds unaffected by the herbicide used may become established and predominant in the planting. This means that the planter must be able to recognise the weeds and act accordingly. Some herbicides are more effective when mixed than applying the same amounts separately, whereas others are incompatible with each other. Wetting agents and new equipment such as nozzles giving very fine droplets have contributed to the efficiency of herbicide usage.

The chemicals used for these purposes in Malaysia today are generally of reduced hazard to animal life. Sodium chlorate is a general contact herbicide; its main disadvantage is that it makes the debris of the sprayed vegetation very inflammable if it dries out; however, that is perhaps less of a risk in the humid tropics and calcium chloride which attracts moisture is sometimes mixed with sodium chlorate to reduce the fire hazard further. At the rates used in Malaysia there does not seem to be any build up of sodium chlorate in the soil; probably the warm moist conditions aid rapid breakdown.

Recently there have been adverse reports on 2,4,5-T arising from experiments with relatively large doses on pregnant mice. 2,4,5-T has been used for nearly 20 years and the risks to humans do not seem to have been substantiated where this herbicide has been applied as recommended. Nevertheless constant reappraisal and the prevention of careless use due to familiarity are always necessary.

New herbicides

The organic arsenicals MSMA and DSMA, monsodium and disodium methyl arsenates, are general contact herbicides, which like most organic compounds of arsenic are almost harmless to animals even in a concentrated form. Paraquat is another general herbicide which dries out the plant tissues sprayed. Pure paraquat is quite poisonous, but many preparations on the market are diluted in unpalatable carriers, so that even deliberate ingestion of a lethal amount is difficult and unlikely. Even so there is legislation to provide for suitable containers and warning labels, in particular to reduce risks of dermatitis due to careless handling. When further diluted to the concentration sprayed there is virtually no risk to animals either by inhaling the spray, by contact or by eating the sprayed herbage; vast quantities—too much for even an elephant—would have to be consumed to reach a toxic level. Moreover paraquat breaks down rapidly in the soil.

Although the above are classified as general herbicides because they kill a wide range of plants; none of them kills all plants; there are certain species resistant to one or other. When resistant species are present; it is necessary to use mixtures or sequence of two or more herbicides, often one general and one specific to control the particular troublesome plant.

2,4-D and 2,4,5-T have already been mentioned, the amine of the former is currently used in a new formulation instead of the salts and esters in the older preparations. These are selective in that dicotyledons (broad leaved plants) are much more susceptible to them than most monocotyledons. The cereals are among the more resistant monocotyledons and 2,4-D preparations have been much used to clear away broad-leaved weeds, although other monocotyledons such as sedges may subsequently become more common in rice fields. Drift of herbicides of this type may do damage outside the area of application. Usually drift is controlled as far as possible in plantation agriculture because sown legumes, rubber trees and even oil palms are susceptible in some measure, so that care is taken to direct these herbicides to the weeds only.

The most commonly used coarse grass killer nowadays is dalapon (2,2-dichloropropionic acid and its salts). It is not dangerous to wild life and breaks down fairly rapidly in the soil. Amitrol is used against some grasses unaffected by dalapon.

Significance of herbicides in plantations

Plantation agriculture of tree and palm crops covers several million acres in Malaysia and is certainly in aggregate the largest single user of herbicides in the country. Now that a ban on the acknowledgedly dangerous sodium arsenite as a weed killer has been proposed, the role of the other less hazardous chemicals in wildlife and natural resource conservation may be assessed.

In the early days clean weeding was practiced. This led to severe erosion on slopes and to reduced organic content and water holding capacity of the soil in all areas. During the next phase there were two rival schools concerning the ground cover between the weeded planting rows; those advocating sown leguminous covers and those who favoured natural shrubs, that is a secondary jungle-like growth kept under control by periodic slashing. All grasses were considered to be harmful.

Recent experimental work has confirmed the beneficial effects of many legumes. Natural shrub covers have been shown to be very competitive unless regularly slashed manually, which is expensive, or sprayed periodically with herbicides to check their growth, which leads to their eventual displacement by other ground covers. These recent experiments have shown that *Eupatorium, Mikania* and *Passiflora* for example have an adverse effect on tree growth. On the other hand the grasses display a wide range of effects from severely depressive (*lallang* and other coarse grasses) to beneficial results little different from those of legumes (*Ottochloa* and light grasses). However, a disadvantage of even the more benign grasses is that they easily invade the planting row, where they compete for applied fertilisers and may induce penetration of the tree collar by root disease fungi owing to provision of ideal incubation conditions.

During the early stages at least, clean weeding of the planting rows is desirable for ease of working, and to reduce competition by weeds for applied fertilisers and water. Later when harvesters must work in the area, ease of access is again important. Therefore experiment and experience have shown that for efficient working, maximum growth and product, the planter needs to keep the planting rows clean-weeded. In the areas between the rows, either a cover of sown legumes or perhaps light grasses should be maintained or, if a cover of less beneficial growths is allowed to arise spontaneously it should be controlled regularly.

Weeds have always been eradicated from certain areas. When manual labour is cheap, this can be done by hand pulling or by hoeing with a *changkol,* which involves soil disturbance, often removes plant debris from where it could provide a mulch, and digs hollows about the trees which later become waterlogged. When

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herbicides are used the debris is left to rot as a mulch on site improving the soil organic content without soil disturbance, which is preferred soil husbandry.

Floral changes

The flora of the plantations is becoming progressively poorer in the number of species present. The oldest plantations are separated in distance by other plantations and in time by two or more generations of crop plants from the original forest. There is no adjacent forest to replenish the stocking of the native flora and fewer species survive each successive replanting. Herbicides—like any other weeding operation—are probably accelerating this process. The sowing of desirable leguminous cover plants to fill the space of displaced weeds is good agricultural practice but also impoverishes the flora. The selective action of some modern herbicides gives rise to a rotation of weed populations and the need to use a sequence of herbicides, this gives some variation in the ground cover and may prevent excessive accumulation of any one herbicide in the soil.

If weeding is accepted as part of agriculture, it is doubtful if the introduction of modern herbicides has done more than accelerate certain changes in the floristic composition, which were taking place in any case. Herbicides are probably an improvement on the old manual methods, which are now too costly for economic operation, by reducing soil disturbance and so conserving soil and moisture.

The changing ground flora may be affecting the wildlife of the plantations, which is sparse in rubber but rather richer in oil palm, by encouraging birds which eat grass seed at the expense of those taking the fruit of secondary jungle trees like figs, although far too little is known about this. There is no evidence to date that the modern herbicides of low mammalian toxicity have been responsible for poisoning any wildlife or seriously affecting the flora or fauna, including fish, of streams and rivers draining the plantations. Micro-organisms in the soil are responsible for breaking down the organic herbicides and rendering them inactive. Therefore one might expect changes in the soil fauna and flora, certain groups becoming more abundant and others, perhaps those responsible for important processes in the soil, being depressed in their activity. So far there is little evidence of this and certainly no signs of bad effects attributed to this cause. There is urgent need to investigate these possible remote, residual or delayed actions, otherwise some unsuspected side effect may grow rapidly to serious dimensions. Nevertheless these have not yet been demonstrated, even if they have not been looked for on an adequate scale, and on balance modern herbicides are beneficial in plantation agriculture including its conservation aspects.

Blanket use of herbicides

During emergency police actions or in wartime, herbicides have been sprayed on roadside scrub and on to forest from the air to reduce the cover available to the enemy. Foodcrops have been sprayed from the air to deny the enemy sustinence. Herbicides such as 2,4,5-T have been employed most commonly. These operations have often been carried out without respect to cost or critical minimal rates to achieve effect. As a result there has been drift over long distances and there have been long-

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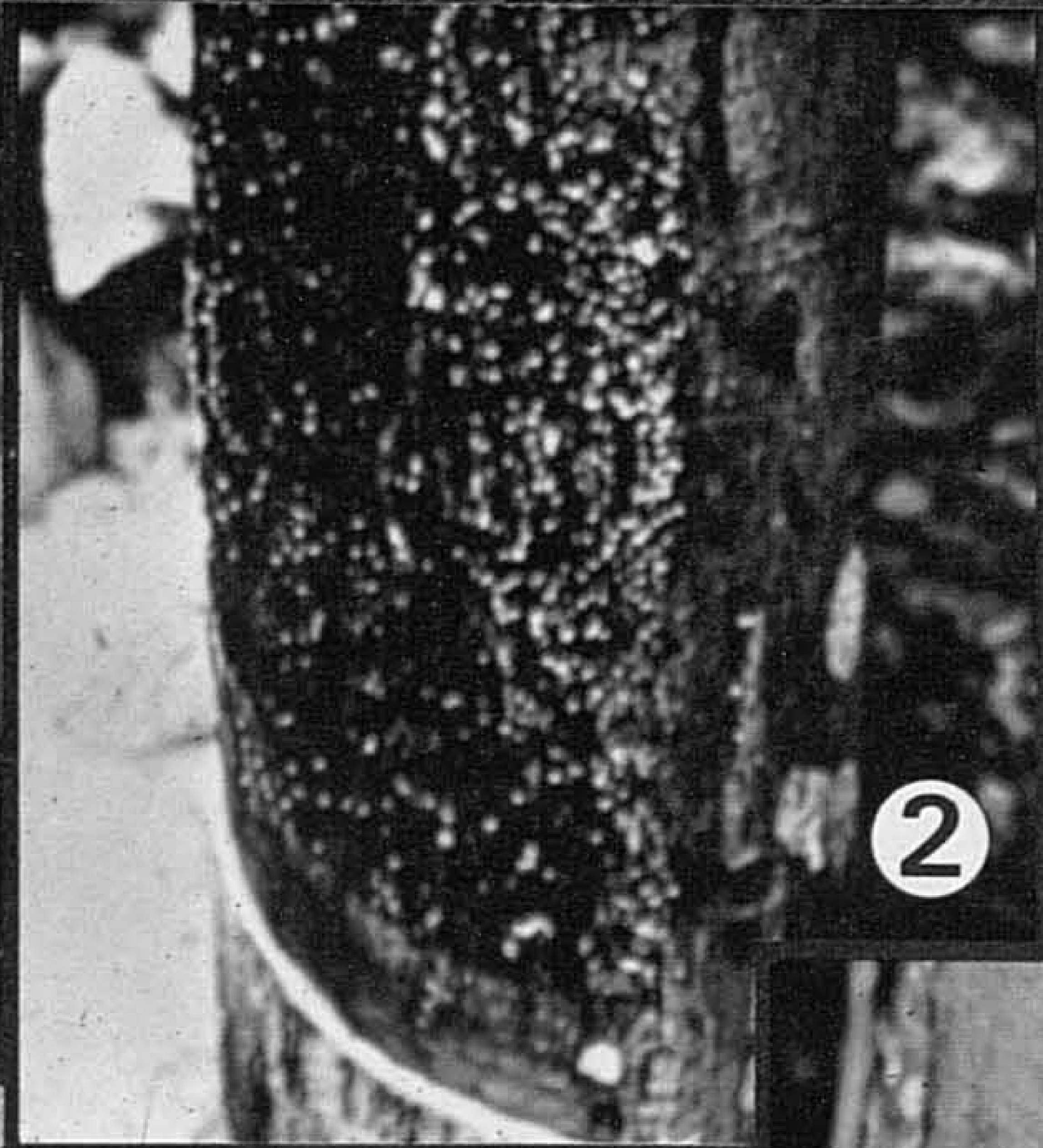

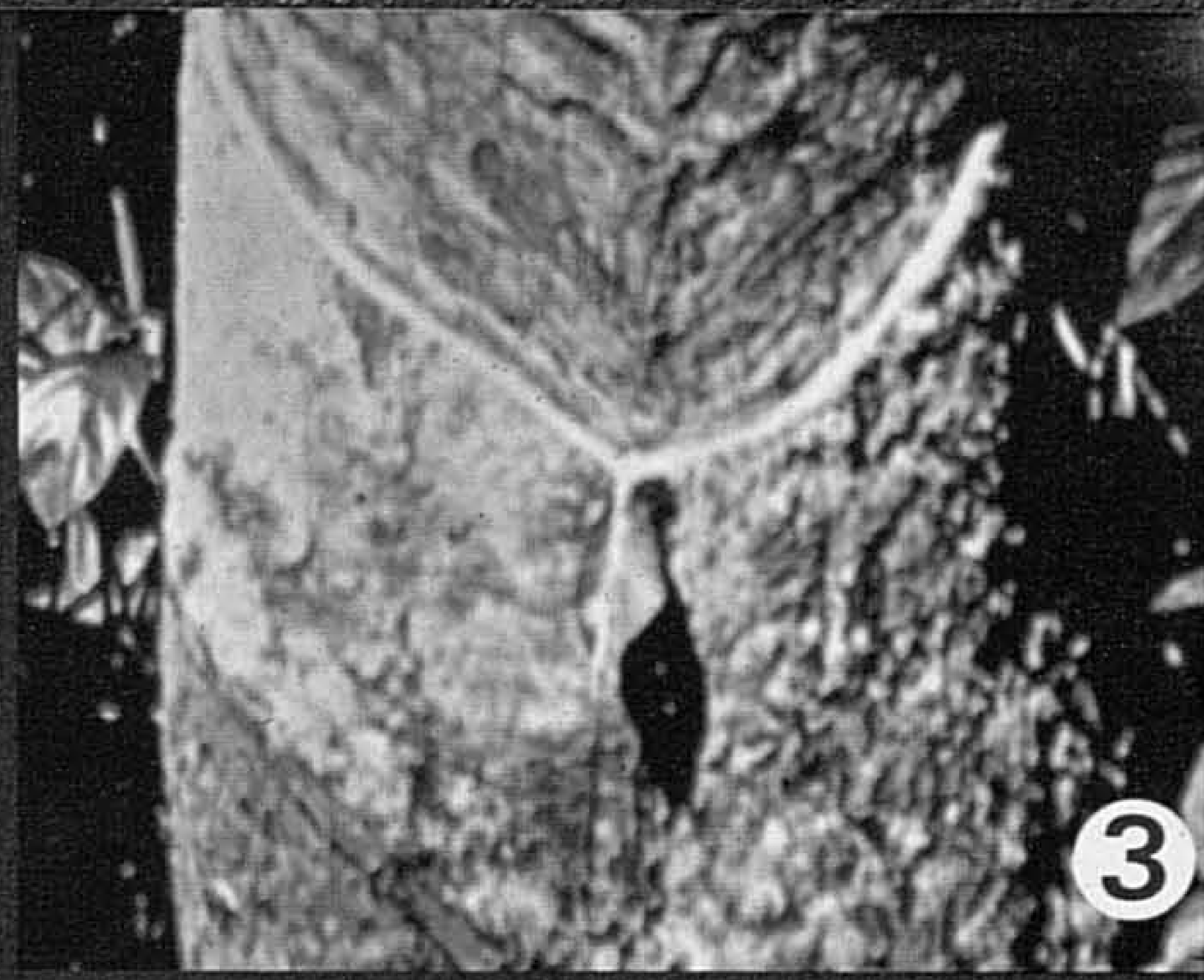

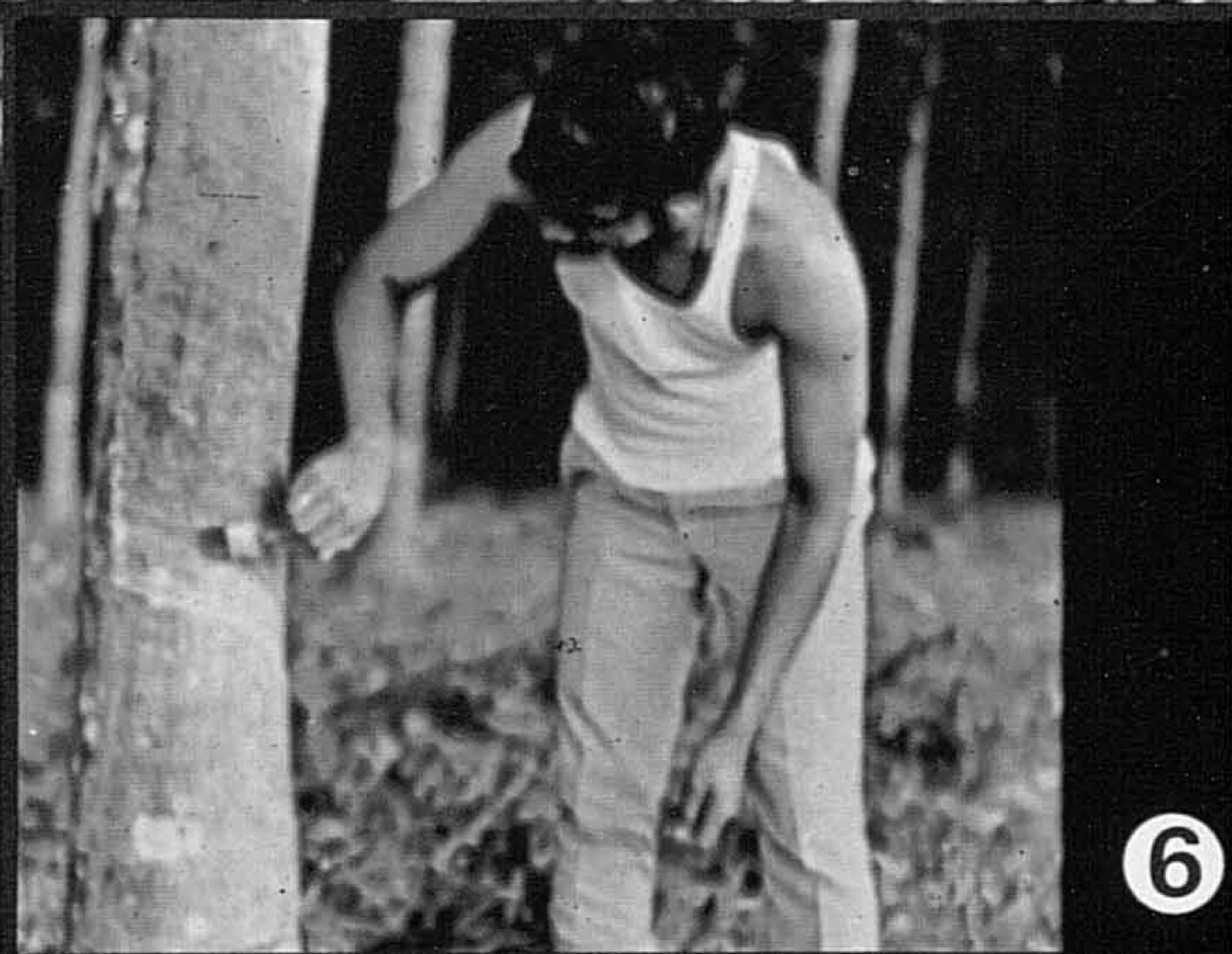

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lasting residual effects and a predominance of coarse grasses in the regeneration. These instances cannot be quoted fairly as examples of the results of herbicide usage.

Secondary and derivative habitats are exploited by the grasses, a highly evolved group among the monocotyledons, which as a whole are believed by many to be more advanced than the woody and broad-leaved plants of the dicotyledons. If so, human activity such as destruction of forests, grazing of cattle, the indiscriminate use of fire and herbicides, may be aiding a larger evolutionary process of world domination by the grasses. The grasses, especially the cereals and the fodder grasses, are valuable to mankind, who in turn is helping the spread of the grasses. This may be regarded as an unconscious symbiosis (the living together of different species for their mutual benefit), or in fact one partner may be the tool of the other; if so, man does not seem to be in control of the situation.

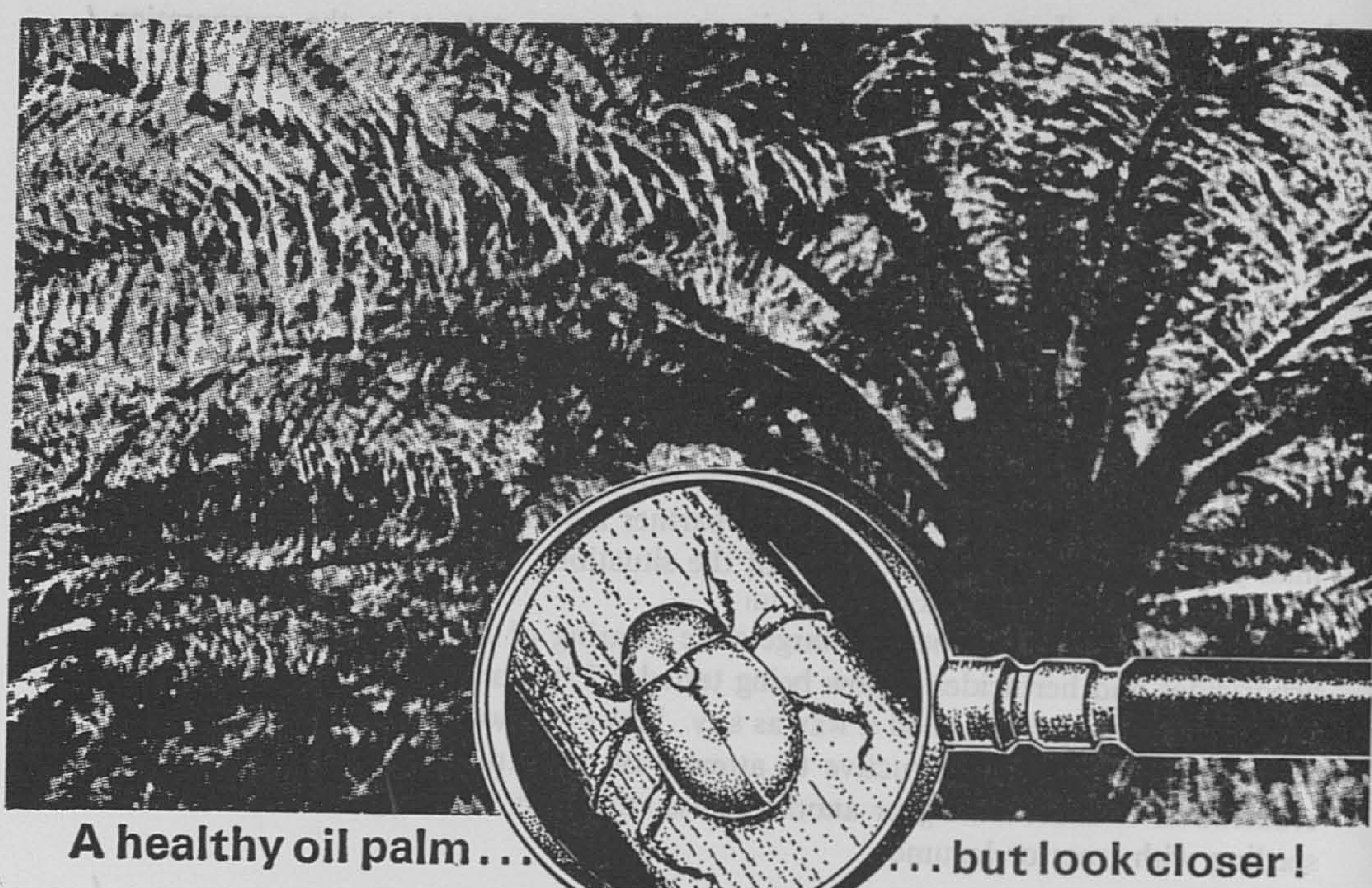
This is speculative, but the large-scale clearing of forest by aerial spraying of arboricides and herbicides is now being tested. If the land is going to be cleared in any case, this may be as good a way as any. However, now that grass-killers are also available, it would be instructive to attempt on an experimental scale at least the eradication of sheet *lallang* or another grass climax by aerial spraying, followed by seeding with trees or legumes.

Fungicides

Fungi are plants unable to make their own food by photosynthesis and live either as parasites of living things and/or as saprophytes on dead plant material. Saprophytic fungi rot damp timber in buildings or fence posts, although in the tropics termites (white ants) are perhaps even more destructive. Timber is treated with chemicals to preserve it from insect and fungal attack. In normal circumstances there is little or no hazard to human or wild life.

Many diseases of plants are caused by fungal parasites. There are three main ways of combating fungal diseases: breeding and selection of resistant plants, cultural practices, and application of fungicides, which are chemicals which should kill the fungus without harm to the crop plant which is host to the parasite. Sometimes one method is adequate, whereas some diseases can only be brought under control by a combination of two or more. The economics of the relative cost of disease control and the value of the crop obtained must be carefully weighed. The soil-borne *Fusarium* fungi cause wilt diseases of many field crops, for instance the Panama disease of bananas; control might be achieved in some cases by soil sterilisation, but this is so expensive that usually recourse must be made to a resistant variety in the case of bananas, or introduction into the rotation of a completely different crop if no resistant varieties of the original crop are available. This gives time for the amount of infective material to decline.

The mildews, including Powdery Mildew which is one of the causes of secondary leaf-fall in rubber trees, attack only the young leaves in most cases. The germinating spores of mildew are easily washed off by heavy rain or by syringing the foliage, a method now confined largely to amateur growers of roses for show. Although dis-



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placed by heavy rain, mildew requires high humidity and water as dew or mist for infection. The germinating spores are susceptible to drying out and also to sulphur dust. Fine sulphur is almost a specific pesticide for mildew among the fungi and for mites among the arthopods. Other forms of life are not affected by sulphur dusting and spraying at the usual rates.

Bordeaux mixture (of 2 parts copper sulphate, 1 part quick lime and 100 parts water) is one of the oldest, cheapest, most widely used and still one of the more effective fungicides for many stem and leaf diseases. The deposit, which dries on the sprayed parts is only marginally poisonous to most animals if ingested, in practice they would have to consume improbably large quantities of bark and foliage to come to any harm.

There is limited evidence from other countries, not Malaysia, that repeated, very heavy applications of Bordeaux mixture may build up concentrations of copper in the topsoil toxic to soil organisms. The other risk is to life in ponds, rivers and streams, especially to fish which take great volumes of water through their gills in order to obtain enough dissolved oxygen to respire and hence may concentrate soluble poisons in their blood, if large amounts of copper salts are carried off in drainage water. To a certain extent these risks are contrary, if the copper is accumulating in the soil, it is not available in solution in the drainage waters, and *vice versa.* The main point is that the rates of application in Malaysia are still relatively small and likely to remain so. Copper is an essential element for plant growth even if in trace quantities, for example a stand of old rubber trees contains about 4 lb of copper per acre. There must be some copper in the soil to support crop growth and cases of deficiency are known. Moderate additions by way of fungicides are beneficial in these cases and by no means harmful in others.

Modern fungicides

The quarternary ammonium compounds are detergent-type chemicals, whose main fungicidal application in Malaysia is to treat stem and panel diseases of rubber trees, and they are virtually harmless to all animal life; careless handling of the concentrate may cause trouble to those with sensitive skins, but this is no greater hazard than domestic washing powders. These detergent-type fungicides might find wider application or be more efficient if they were not so easily eroded by the rain; the incorporation of greases may be the answer. Tar and bitumen have their uses and by their nature are not hazardous.

The dithiocarbamate group of fungicides are used to control a number of leaf diseases and to prevent 'damping off' of young seedlings, in which the latter are attacked at or near ground level by moulds. These carbamates have various metal bases, such as iron or zinc, and most are only marginally toxic, for instance a man would have to eat a teacup-full of the most unappetising pure substance to come to grief. They are sprayed at such low rates as 2 lb of active ingredient per acre or 1/5th of one per cent concentration. There is no evidence of risk to wildlife by inhalation of drifting spray or ingestion of sprayed foliage or fruit at these concentrations, or of any build up in the soil.

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)

SPM SUL-PO-MAG ®

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.

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.

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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.

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The collar protectant to prevent penetration by white root disease of rubber is based on pentachloro-nitro-benzene, which has negligible toxicity for most animals. Pentachlorphenol on the other hand is much more dangerous, but this is mainly used to treat timber. Thiram also falls in an intermediate category for toxicity. Thibenzole, now used in oil palm nurseries, is also used to free sheep and cattle of worms by drenching them in its solution. It is a rather safer and more effective fungicide than thiram in some respects.

The most dangerous fungicides used in Malaysia until recently were the organic-mercurials, as little as one twentieth of an ounce of the pure substance could kill a man. If these were sprayed, damaging amounts might be inhaled if the operator did not wear a respirator and goggles, which are uncomfortable in the humid tropics and liable to be left off with serious consequences. These organic-mercurials were recommended to treat those panel diseases of rubber trees which did not respond to the detergent type fungicides. The organic-mercurials should be painted on, even so gloves should be worn, all contact with concentrate, solution and treated surfaces avoided, and even if gloves are worn the hands should be washed thoroughly before eating or smoking in case of accidental contact. Very little animal life, apart from humans, is liable to handle these chemicals or to come into contact with treated panels. The risk to wildlife is not great, but it is obviously desirable to replace such dangerous chemicals with safer materials. Captatol (in a formulation called Difolatan) is one of several new fungicides which seem to be satisfactory in this respect. In other countries the organic-mercurials have been used as seed dressings for cereals, often with serious consequences for birds, fish and possibly humans.

Cultural control of fungal diseases

The reduction of the incidence of root diseases in the new stand of rubber by poisoning the old trees has been discussed in the section on arboricides. The establishment of leguminous covers also helps to rot away old stumps which may be sources of infection before they can do any harm. Organic matter rots faster the lower the ratio of carbon to nitrogen; old stumps are rich in carbon and rot slowly, but this can be speeded by adding nitrogen. The favoured leguminous covers enrich the soil, or any stumps they scramble over, by symbiotic nitrogen fixation. The establishment of a creeping legume cover has been shown in experiment to reduce the incidence of root disease. This is the third beneficial effect of leguminous creeping covers mentioned in this manual: first the prevention of erosion, second soil enrichment and improved circulation of nutrients, now the reduction of root disease losses. Blessings do not come singly when natural processes are harnessed to good effect. In this and the following case curative fungicidal treatments have not been found, collar protectants are only preventive measures in rubber to reduce spread of the disease.

Basal Stem Rot of oil palms caused by *Ganoderma* is serious if old coconut palm trunks, the stems of wild palms or to some extent old oil palm stumps themselves are left lying around in new plantings or replantings of oil palm. Burying these sources of infection is the most economic way of dealing with this risk but burning instead of burying is more satisfactory; whereas neglect of these precautions usually leads to severe losses.

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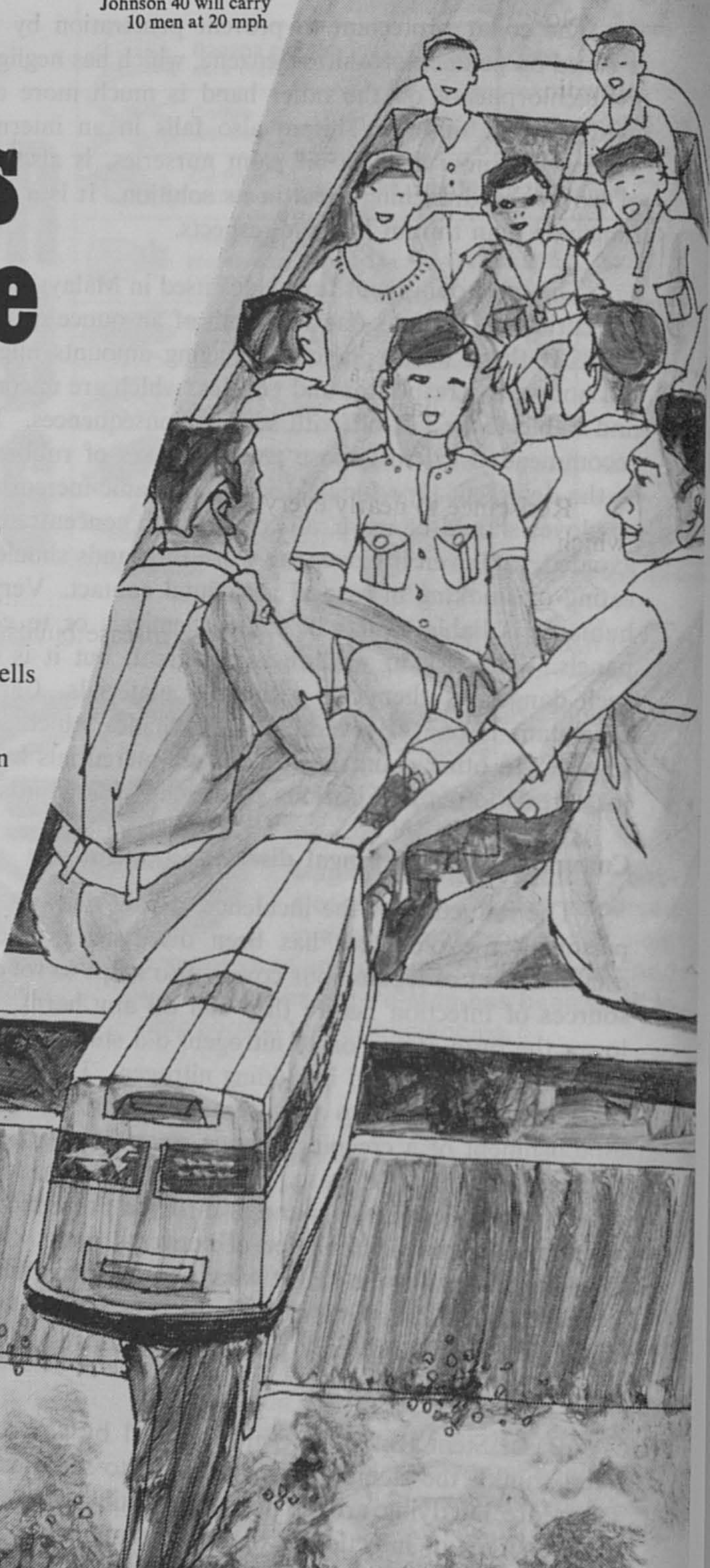

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Slow growth due to overcrowding or inadequate fertilisation or irrigation of many crop plants predisposes them to infection. Excessive humidity due to overcrowding increases disease incidence in the nursery and panel diseases of rubber are prevalent if dense undergrowth is unchecked. Good cultural conditions help to cut down the fungicide bill considerably. Preventive cultural measures are often longer-lasting than curative treatments by spraying.

Genetic resistance

Few if any plants have been found resistant to the root diseases, whose containment is largely by cultural methods or plantation hygiene to reduce the contacts between the tree crop and sources of infection, assisted by treatment or destruction of cases when diagnosed. The situation among the leaf and stem diseases is very different.

Resistance to nearly every leaf disease has been found in some individual plants, which may be multiplied if vegetative propagation is possible. Some populations of plants have a larger proportion of resistants than others. Many crop plants have been bred and selected for yield over several generations without adequate attention to disease resistance. Thus when the disease builds up to serious proportions, it is often found that the highest yielding varieties are susceptible, but the resistant strains are low-yielding. Breeding and selection programmes are then necessary to combine the desirable features of high yield and good resistance. This may have to be done for more than one disease at a time.

Resistant high-yielding material is the simplest method of economic control of disease, the main difficulty is that it is a long-term programme in a world which urgently demands quick results. Sometimes the resistance of a selected variety breaks down; what actually happens in most cases is that a new strain of the disease has evolved which can attack the hitherto resistant selections. An interim measure possible in rubber is to bud-graft a resistant crown on to a susceptible but high-yielding trunk.

Resistance may have been lost in cultivated varieties or may break down. Almost invariably search among the wild plants of the same or closely related species of the crop will discover resistant—even if low-yielding—material, which can be taken into the programme. The discovery of new disease resistant strains is dependent on a supply of wild plants. It is quite impossible to collect and keep alive examples of every naturally-occurring variant in a series of huge botanical gardens. The only practicable way is to preserve examples of every known types of vegetation so that nature itself can be the genetic storekeeper. Malaysia is the centre of the range of the wild bananas, *Musa,* and several collecting expeditions to the forests and aboriginal *ladangs* have been arranged in recent years. The same argument applies to every crop and country. Apart from the native fruits, banana, durian, mangosteen, rambutan, jackfruits and relatives, Malaysia has provided important breeding material for the improvement of rice and sugarcane. The recent discovery of a new wild *Citrus* is important.*

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* *Planter, Kuala Lumpur* **48:** 90–92 (1972)

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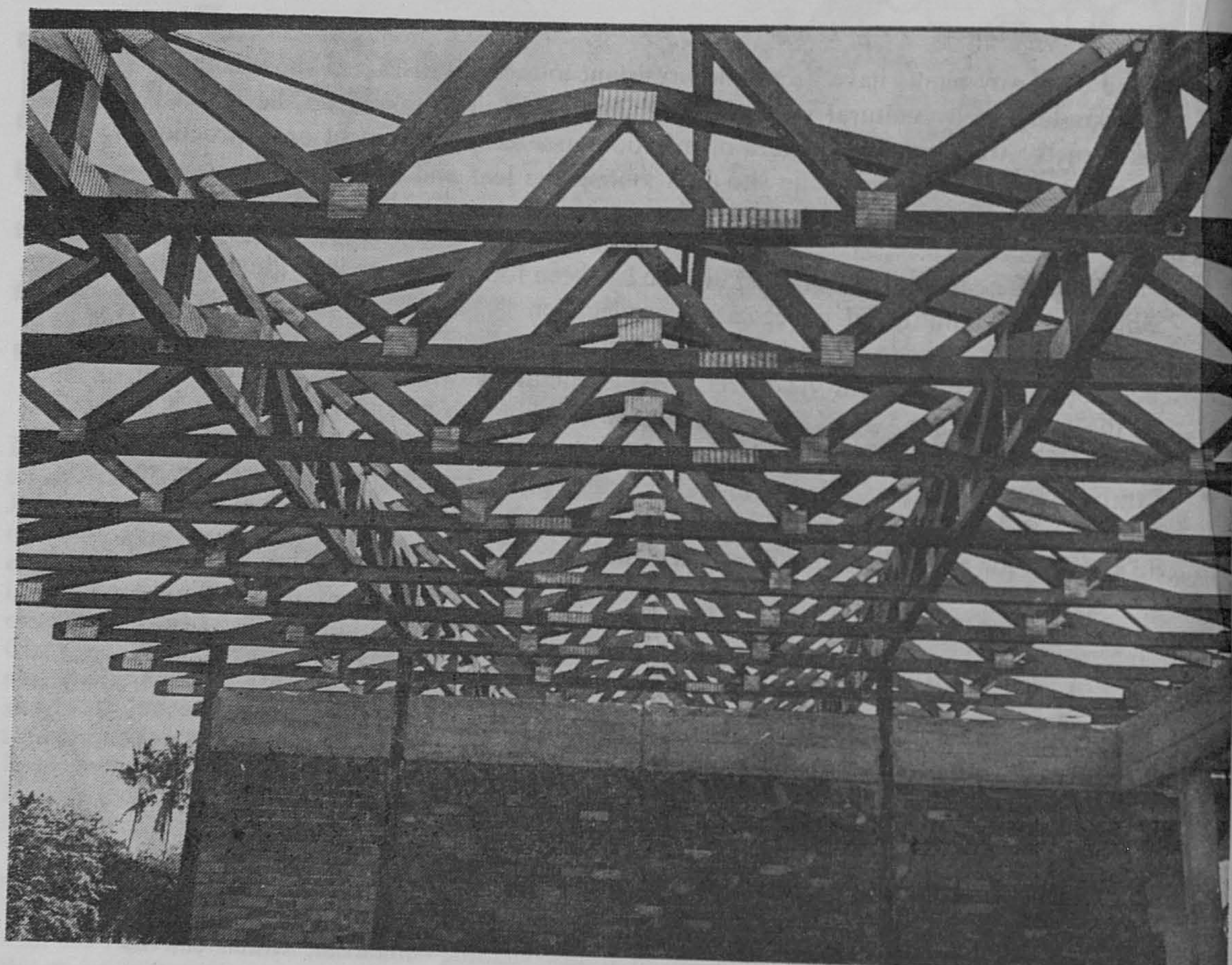

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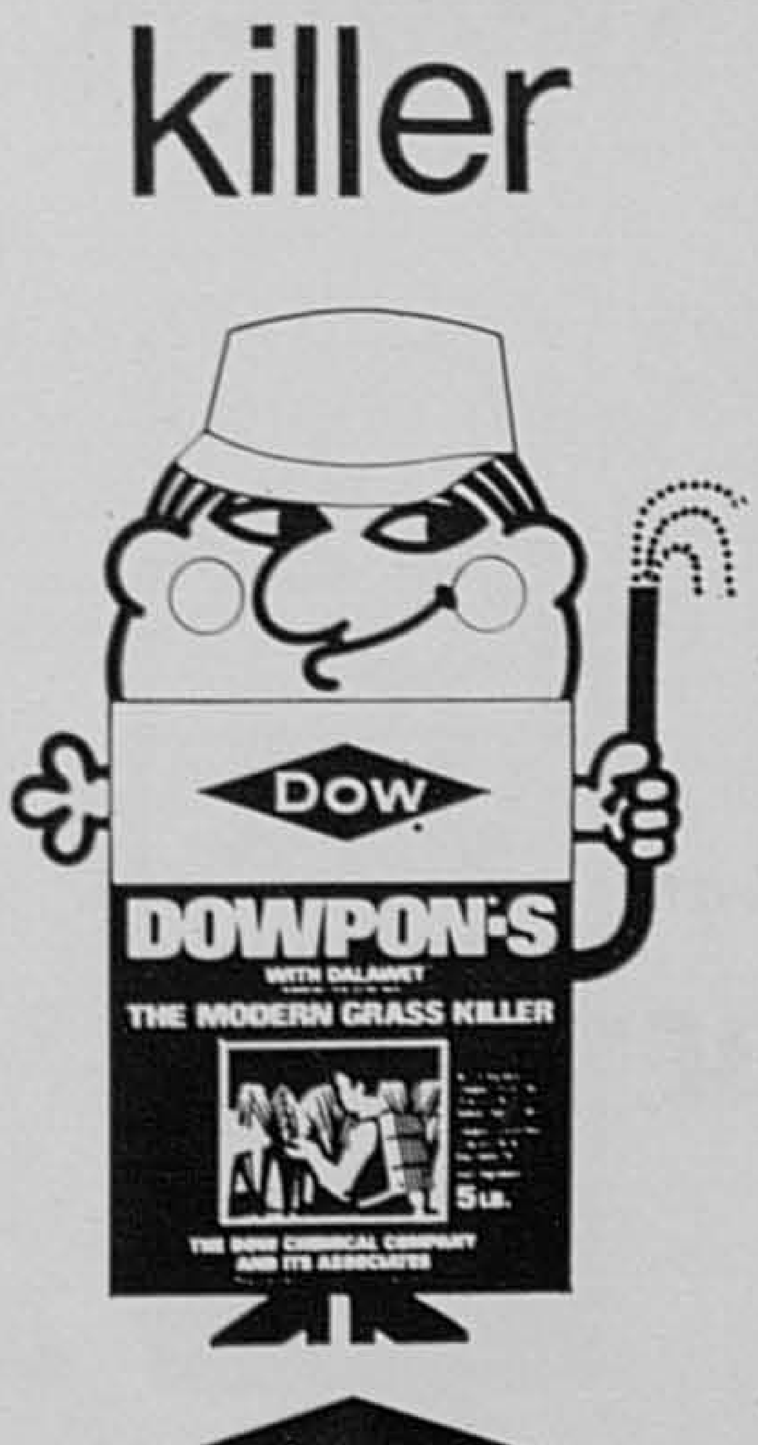

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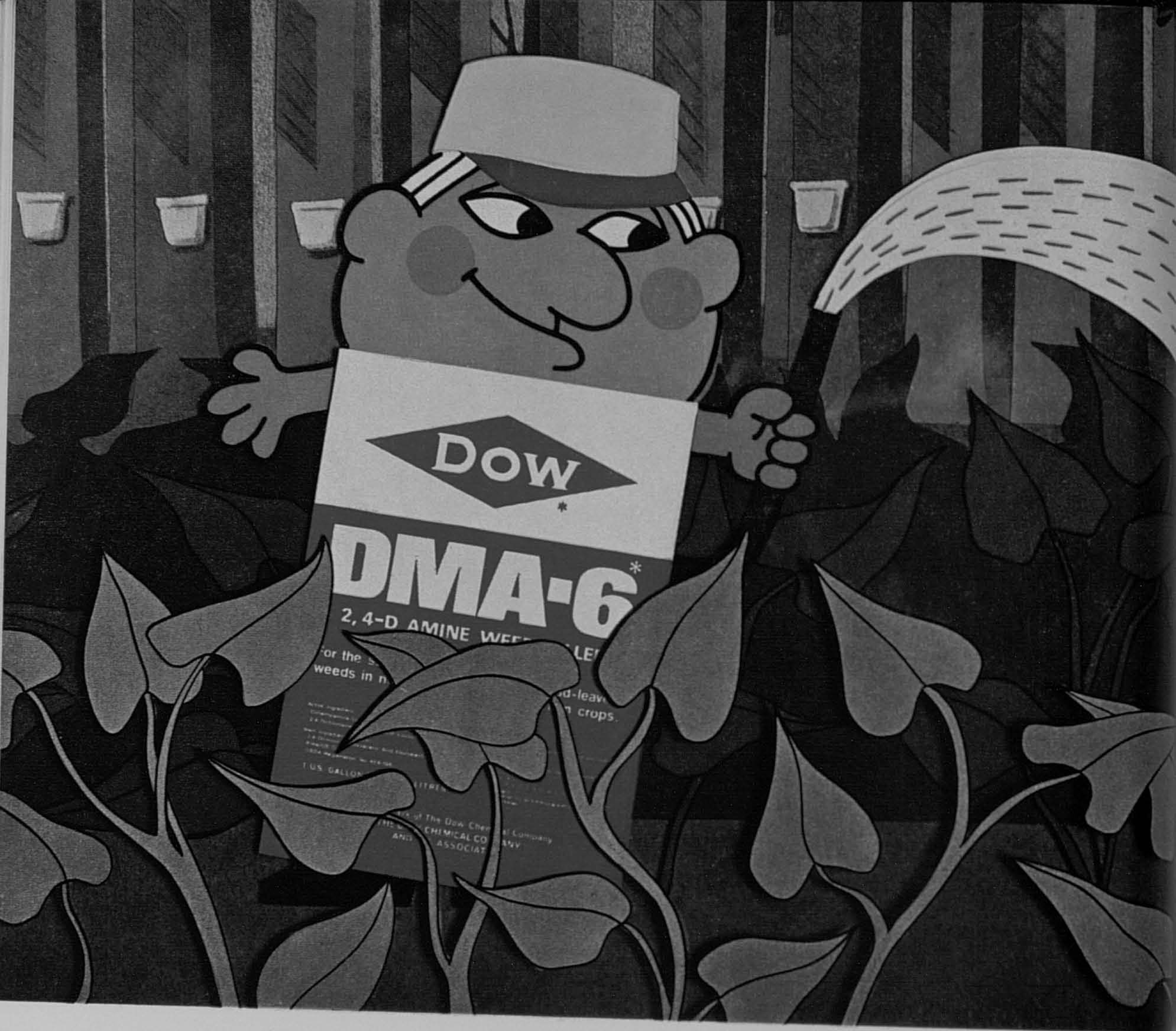

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DMA-6 from Dow. No matter what your problem is, broad leaf weeds, hairy or woody stemmed weeds, a mixture of weeds of all shapes and sizes, even tough and hardy grasses, DMA-6 kills them all, completely. For selective weed control, just mix DMA-6 with water. It will kill off broad-leaf, hairy and woody stemmed weeds. A dose of DMA-6 with Sodium Chlorate, Lissapol and water gives you total weed control over a mixed company of weeds, while

DMA-6 with DOWPON-S, MSMA 529 and water is fatal to tough and hardy grasses. Just spray on the foliage and watch your problem wither away. DMA-6 is non-poisonous and non-toxic to your crops and animals. And a hint from the doctor from Dow. For economical application use either the 5 or 55 US gallon drum of DMA-6. DMA-6, another example of Dow's commitment to making your profit grow through agricultural science.

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*Trademark of the Dow Chemical Company.

Another interim measure is to plot carefully the distribution of plant diseases, for instance *Oidium* or Powdery Mildew of rubber is more common in North Malaya and the Interior of Sabah, but *Gloeosporium* leaf disease is more common in south Malaya and south-west Sabah. Some reasonably high-yielding varieties are susceptible to one disease but resistant to the other and *vice versa*. These can be planted in the respectively appropriate areas, although there is some risk that the diseases may spread but this is likely to be rather slow.

With the exception of the organic-mercurial compounds, which can now be replaced for most uses in Malaysia, no fungicides used in Malaysia are very poisonous to animals. None are applied in dangerously large quantities. Cultural control measures are well appreciated, breeding and selection programmes to combine yield and resistance are in progress. The situation appears satisfactory provided there is constant improvement and no relaxation resulting in ground being lost. The cautionary remarks about the pesticide revolution may seem uncalled for, but the next group—the insecticides—should dispel any such illusion.

(Next month: AGRICULTURE cont.)

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The monthly crop

Registration proceeds apace for the Society's International Oil Palm Conference (16–18 November) and intending participants are urged to return their forms at an early date. It is announced that the hosts of the Conference Cocktail Party, to be held in the evening of the first day, will be the Monsanto Company. The Federal Hotel, Kuala Lumpur, where the Conference takes place, have announced special rates for participants who stay there and a leaflet giving details of these is included with this issue.

A bird's eye view of Dutch elm disease is shortly to be taken in Britain. We have referred previously to the use of photography in detecting this serious disease and it is now reported that aerial photographs are to be taken over west Sussex that should pinpoint every affected tree, even those where the disease is in an early stage. If successful, the experiment would mean that rapid surveys could be carried out over large areas. Meridian Air Maps, the company undertaking the test photographs, will use a colour film which has had one of its three emulsion layers removed and replaced by an infra-red one. Healthy vegetation will show up as vivid magenta, while diseased trees, which have lost chlorphyl from their leaves and are unable to reflect the infra-red back up to the camera, will remain green or look grey or black.

On the heels of our tilt last month at the users of political jargon and journalese, comes a real 'winner'. The palm for perishable prose goes to a Government official who is reported in *The Straits Times* as announcing plans for organising 'grassroots seminars' for rural people. "In this way" he said "we'll get a *concrete feedback*"!

A new source of protein derived from mushrooms and other cellular plants may improve the diets of people in developing countries and reduce food costs, Professor Arnold Spicer, director of the Lord Rank Research Centre told delegates at the British Veterinary Association Conference recently.

He said fungi protein could create a revolution in human nutrition similar to that caused in the textile industry by synthetic fibres. A process to be marketed commercially in Britain next year would produce 600 tons of protein a week in the initial stages—enough to provide nutrition for 2 million people a week at a lower cost than conventional food.

Fungal protein has a higher quality than meat protein and it can be given a wide range of flavours by using the same chemical reactions as in nature instead of artificial chemical flavourings.

Protein produced from fungi, said Professor Spicer, can be baked, fried or puffed into rice-like food. It has the added advantage of being able to be produced locally, enabling developing countries with food shortages to feed people from local resources.

Free seized-up parts! Any reader wishing to take advantage of this generous offer will find further information on the tin of a well-known brand of penetrating oil.

The final of the Selangor Planters' Association Estates Football Competition between the Rubber Research Institute Experiment Station and Oil Palm Research Station was played on 26 August on the Town Padang, Klang.

The game began cautiously with each team probing for weaknesses in the other. Midway through the first half, OPRS had rather a lucky break when a shot from its inside right was deflected into the net by a RRIM defender. RRIM then mounted a determined effort to get the equaliser but their opponents managed to hang on to their slim lead until the interval.

The pattern of play was the same in the second half with RRIM having the lion's share of the attack but with their forwards failing to score because of poor finishing. On the other side, OPRS looked dangerous in breakaway raids, particularly from the left flank.

RRIM Experiment Station could not however be denied their equaliser, which came in the 60th minute. The move started from mid-field and the ball switched to left winger Goh Heng Jin. He lobbed the ball in the box and V. Kally connected it well, sending it into the net from 6 yards. Both teams tried hard to score the winning goal, but the deadlock remained unsettled even after extra time.

RRIM Experiment Station and Oil Palm Research Station were therefore declared joint-champions for the 1972 competition, the final score board being as follows:

Selangor Planters' Association Estates Football Competition—1972

TEAM	*P*	*W*	*D*	*L*	*F*	*A*	*Pt.*
Oil Palm Research Station	8	8	0	0	24	2	16
R.R.I.M. Experiment Station	8	7	0	1	33	4	14
Dusun Durian Estate	8	6	0	2	20	7	12
Prang Besar Estate	8	3	1	4	13	19	7
Ampar Tenang Estate	8	3	1	4	8	21	7
Pilmoor Estate	8	2	2	4	7	8	6
Edinburgh Estate	8	3	0	5	7	21	6
St. Andrew Estate	8	2	0	6	3	21	4
Elmina Estate*	8	0	0	8	1	13	0

* Withdrew after Round 4.

P — games played
W — games won
D — games drawn
L — games lost
F — goals scored by the team
A — goals scored against the team
Pt. — points gained, calculated on the basis of 2 for a win and 1 for a draw.

They must have laughed all down the side of the Cessna. Up in Ipoh that is, where the Royal Perak Flying Club has been giving joy-rides as part of the Sultan of Perak's birthday celebrations. *The Straits Times* reported that adults were charged $12 and children $6 '*for a 15-minute spin*'. At those rates one should be able to get an outside loop for a dollar.

Mutton Pasanda Badam is our gustatory offer this month (page 274) and from now on we shall be publishing regular delights from hoof, feather and fin. A member reports that his wife ripped Chicken Tandoori out of his *Planter* last month, on being forbidden to take the magazine into the kitchen. From this month the recipe will appear on a detachable page, to prevent such ugly scenes.

What's in a name? A newly-formed Malaysian company will soon find out. In association with the great Philips concern the new company will manufacture electronic parts in Malaysia and has called itself Maltronics. This suggests, unjustifiably of course, that the parts aren't going to work. Let this be a warning to any local firm of caterers which is thinking of naming itself Malfunctions.

$243,250 for bids on new car numbers reads a Singapore headline. The Registrar there has collected this sum from bids for new car registration numbers since the scheme started in 1970. The highest bid so far has been for SQ1 which went for $11 100. An interesting situation looms in the State of Negri Sembilan where NG5555 will shortly be coming up; our non-Chinese-speaking readers may not know that Ng means '5' in Cantonese.

Pictures wanted

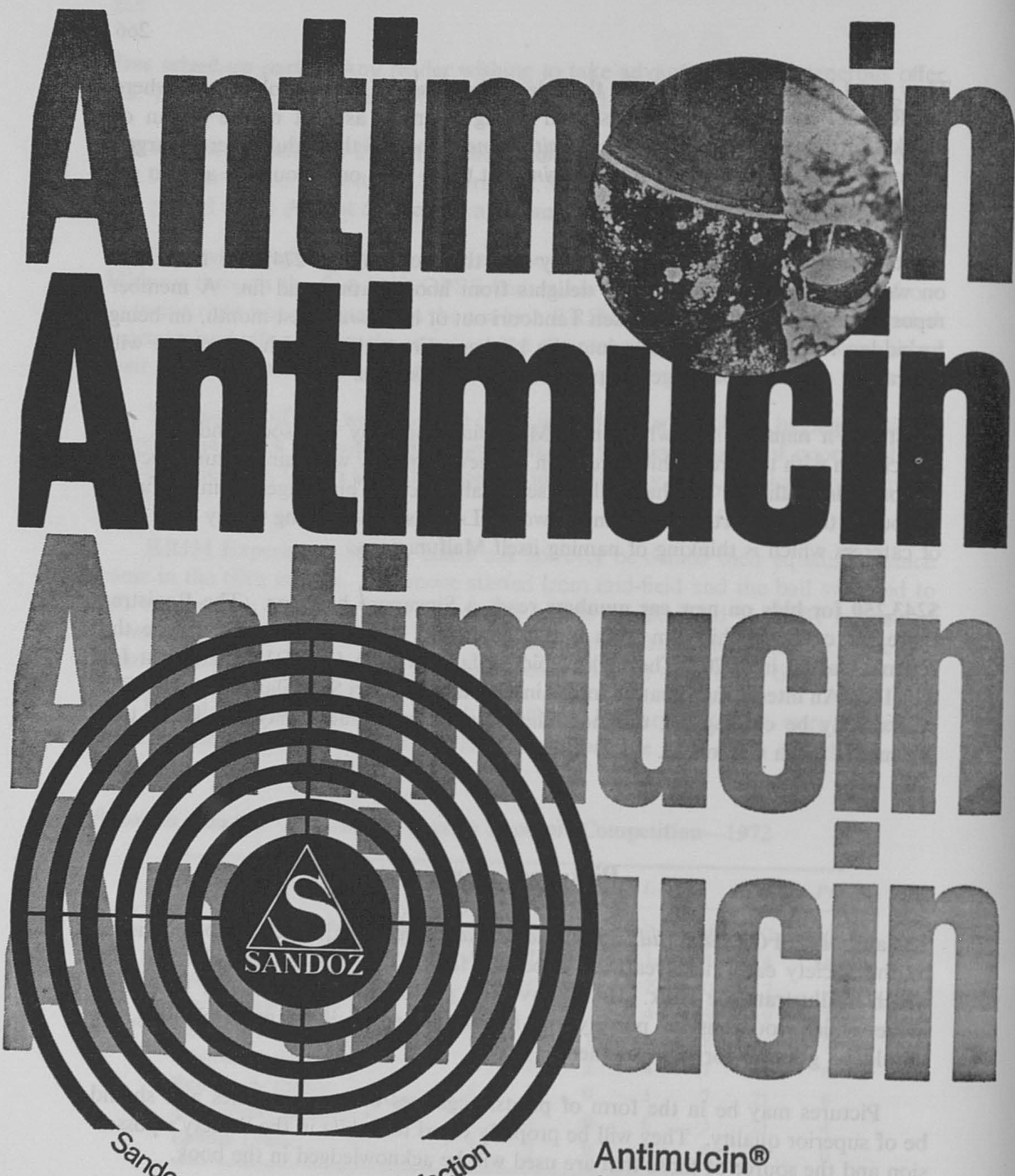
The authors* of *Oil Palm Cultivation and Management*, a major work to be published by the Society early next year, are appealing for the loan of suitable pictures with which to illustrate the book. If you have any photographs, in colour or black and white, which you consider portray any important aspect of oil palm planting, we should be grateful for sight of them.

Pictures may be in the form of prints, negatives or transparencies and should be of superior quality. They will be properly cared for while in the Society's possession and the source of those that are used will be acknowledged in the book.

Please send your material to the Executive Secretary, ISP.

---

* *Dr P D Turner & Mr R A Gillbanks*



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Letters to the Editor

Dear Sir,

Labour intensiveness of rubber tapping

I am an estate manager with a too-numerous resident tapping force and I find it difficult to dispense with the services of even one tapper proved to be unsatisfactory; this is because of Union stubbornness.

You have made several references in recent months and particularly in your May editorial, *The Facts of Life* to this problem. You there suggested that a way around the problem would be to retrench the wife of a husband-and-wife pair of tappers and that this would not occasion hardship by comparison with the household of a town-dwelling vehicle driver. You quoted a take-home pay for the average tapper of $96.20 for 26 days' work and the average urban vehicle driver of $135.

Because of the present poor rubber price I have been considering the introduction of Ethrel to put up my yield per tapper and thereby increase profitability but I am advised that I must switch to third-daily tapping systems with Ethrel. All tapping here is alternate-daily and my task sizes below national average.

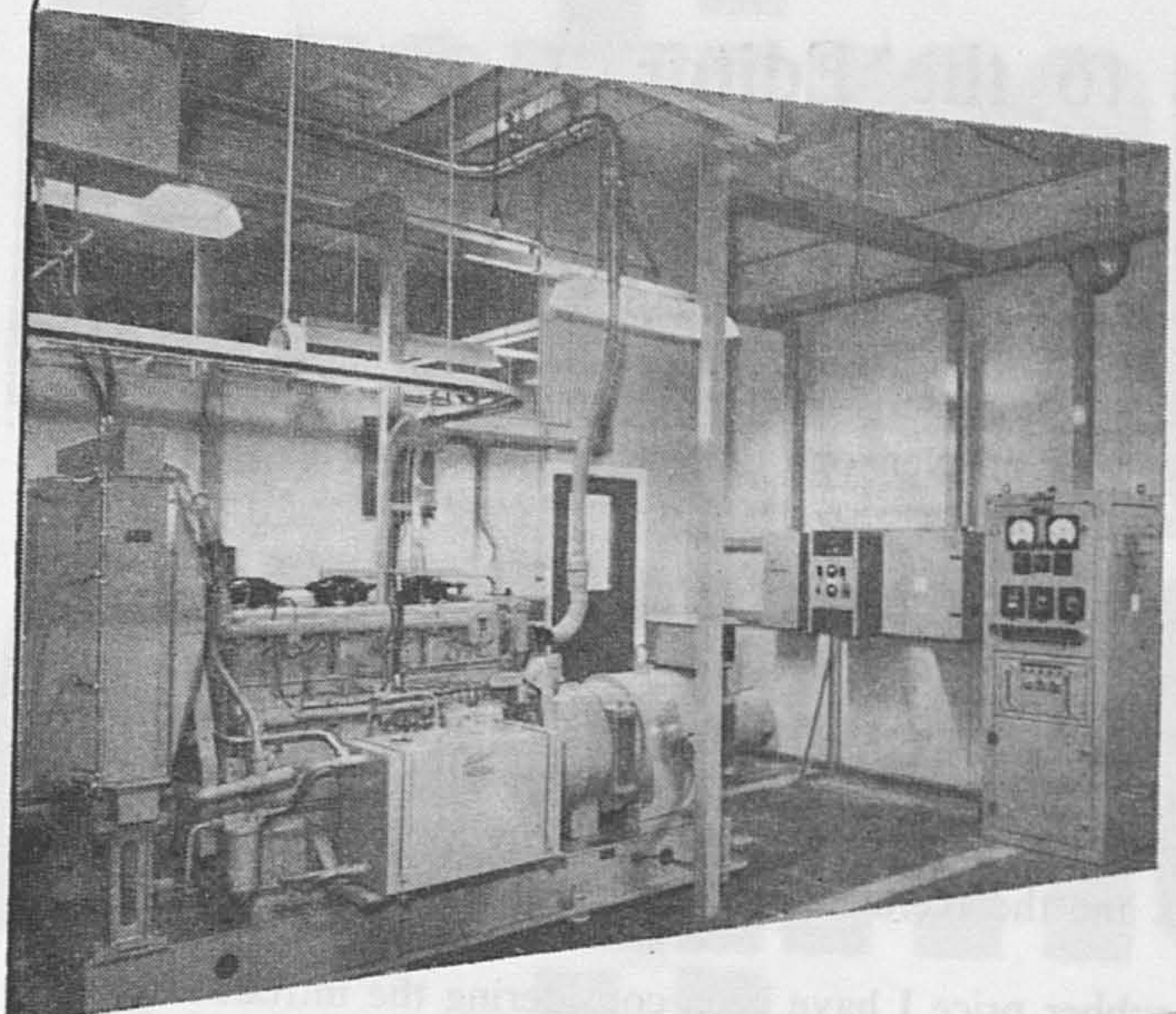
With a view to broaching the matter of paying-off some of my married females with the union, I have been looking into the family incomes among the husband-and-wife teams. By the standards of this estate, you have well understated your case.

Here are the incomes for August of three such couples on this estate: —

			Pay (after EPF) $ ¢
Pair A	Wife's earnings	(28 work days)	135.61
	Husband's earnings	(31½ work days)	172.58
		Household income	307.19
Pair B	Wife's earnings	(30 work days)	154.77
	Husband's earnings	(31 work days)	185.82
		Household income	340.59
Pair C	Wife's earnings	(22 work days)	78.71
	Husband's earnings	(19½ work days)	100.00
		Household income	178.71

All workday totals include one day's payment for a washout.

For an average resident tapper you can add $40 per month to cover medical attention, sick pay, leave pay, holiday pay, maternity benefit (averaged over males and females). Accommodation, light and water are supplied free although light is "rationed".



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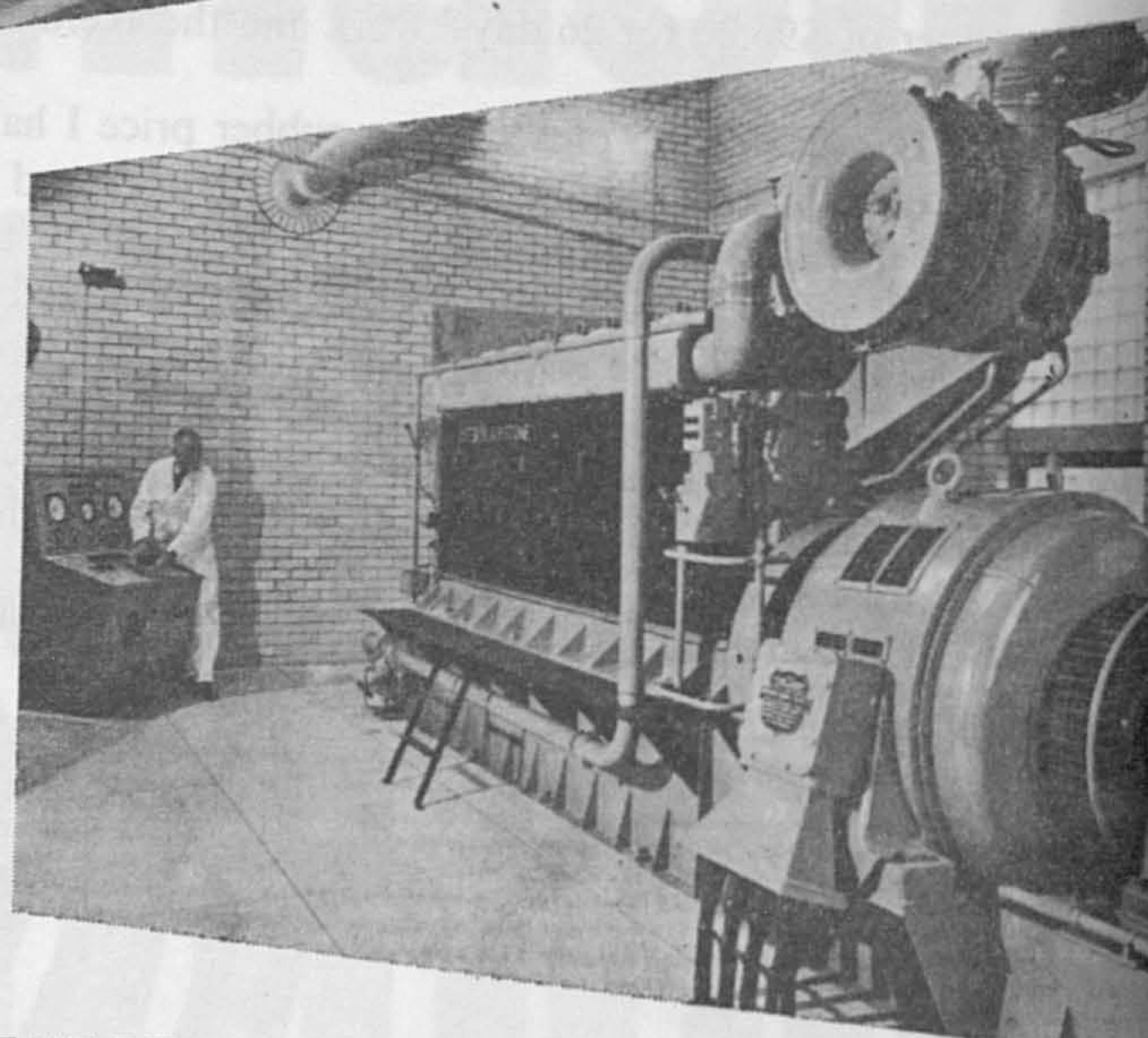

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Presumably your urban driver would have to pay about $40 per month for rent and about $10 for light and water, leaving him with a net income of about $85, less any medical expenses. Certainly, by comparison, the families whose incomes I have given above would not suffer hardship if the wife retired from tapping and took her proper place in the home.

For fear of prejudicing my forthcoming negotiations with the Union, I hope you will permit me to sign myself.

Harrassed Estate Manager
(Name and address supplied)

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Book review:

The Oil Palm, its Culture, Manuring and Utilisation

By NG SIEW KEE, pp 142, International Potash Institute, 1972. M$12.00

The number of books about the oil palm continues to increase. Presumably the number of readers does also, judging by the sales of major texts in Malaysia where some of the more important ones are already out of print. Because of this, new ones—and even new editions—need careful consideration. For whom are they produced? Do they contain new material? Is the indicated subject range fully covered? Are they well written, printed and produced? Are they reasonably priced?

It was in this context I read Dr. Ng's book and, I confess, I was somewhat disappointed. Because of the eminence of the author in the field of oil palm nutrition and the fact that the book has been sponsored by the International Potash Institute, I had hoped for an up-to-date monograph on world-wide fertiliser usage. Perhaps it is the difference in the approach to fertiliser problems, which is so evident when comparing Africa and the Far East, that has prevented a meaningful comparison and evaluation. Although nearly half the book is concerned with "Nutrition and Manuring", the bulk of this very long Chapter 8 consists of experimental results, some of them quite old, presented with limited critical comment on their relevance to commercial practice. As on many estates in this part of the world, the 'per acre' cost of fertiliser is well over half the total annual field costs, some mention of the economics of fertiliser use would surely be pertinent.

The book describes, in the usual sequence, the importance of oil palms, their distribution, ecological requirements and botany; followed by the growing and manuring of the crop, and finally with processing and end use. Most of the chapters give too little practical information for a grower, but possibly too much for the general reader. They are very fully documented and this is a most valuable feature which is often missed in texts of this sort. I believe, however, that the book, as a whole, would have been of more use in Malaysia if the practical chapters had been expanded somewhat: profitability discussed and some of the unnecessary tables omitted. Lists of chemicals which can be used as herbicides or for crop protection are rather pointless, and can be dangerous without a thorough discussion of their side-effects and application rates. A more detailed index would be advantageous too. However the book has been very well produced and the number of printing errors are relatively few; but there is some evidence of hurried proof reading and there is inconsistency in naming some territories (Congo v. Zaire, for example). The printers' name does not appear.

All planters and research workers in oil palm should and will read the present book but may think, as did this reviewer, that here is not the definitive work on oil palm nutrition and manuring which they would have hoped for from this uniquely qualified author.

CJP

Notwithstanding the reservation of our reviewer the Society has undertaken the sale of Dr Ng's book which is now listed among publications available to members. The price is as quoted above and postage is free.

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Tuan Haji Ahmad Zakaria bin Abu Kassim awarded Pingat Jasa Kebaktian (PJK) by HRH Sultan of Perak.

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Vincent Tan	($100)

Births

MENON: To Sreelatha and Muralidhara, a daughter Priya, sister to Maya, on 11 July 1972 at hospital, Kuantan.

MENON: To Mary and Eugene, a daughter Shireen Louise, at Assunta Hospital, on 6 September 1972.

WALKER: To John and Kee, a son Frederick Alexander, brother for Grace, on 14 September 1972.

On leave

5008 Baskett, J P C, AISP, Oakleigh, Kilmington, Axminster, Devon, England.

3357 Brooker, C C, PJK, JP, c/o H J Brooker, Esq, 11 Haileybury Road, Orpington, Kent, England.

4498 Willis, P G, c/o Lloyds Bank Ltd, Cox's & King's Branch, 6 Pall Mall, London SWIY 5NH, England.

4258 Zelvelder, C A, c/o 8 Vredeman de Vriesstraat, Leeuwarden, Holland.

Returned from leave

4815 Blincoe, A D, Sungei Senarut Estate, Batu Anam, Johore.

4332 MacQuistan, J G, Changkat Salak Estate, Salak North, Perak.

4465 Petersen, P E, Sungei Bernam Estate, Teluk Anson, Perak.

Change of address

4306 Chua Teik Hwa, AMBIM Eng, Middleton Estate, Rompin *via* Gemas, Negri Sembilan.

5362 Cho Fong Yen, Buntar Estate, Ghim Khoon Division, Serdang, Kedah.

5661 Chin Thiam Choi, Silabukan Settlement Scheme, c/o P O Box 211, Lahad Datu, Sabah.

5826 Daud bin Md Amin, C3, Tingkat 2, Bangunan MARA, Jalan Misjid, Kuala Trengganu.

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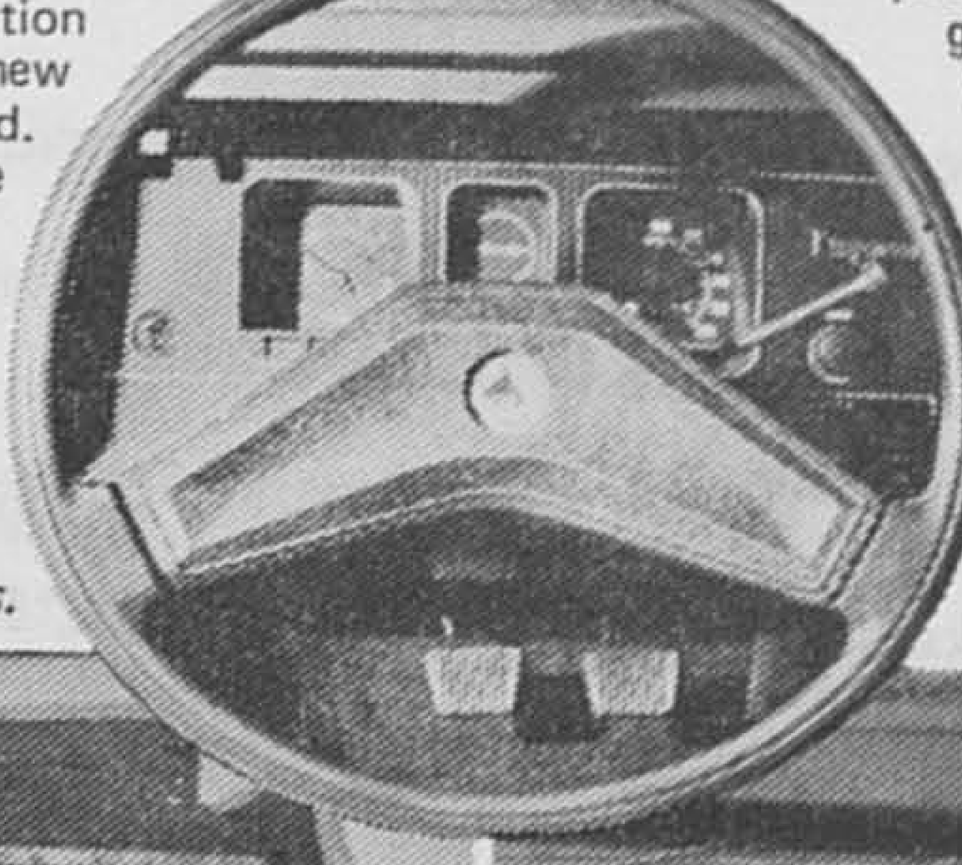

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4246 Fair, E M, AISP, Ulu Yam Estate, Rawang, Selangor.

5451 George, A, Harvard Estate, Bedong, Kedah.

5197 Helmi bin Syed Noh Shahabudin (Syed), Tanjong Rambutan Estate, Tanjong Rambutan, Perak.

5250 Hoh Kam Yong, Christopher, Apas-Balung Factory, Sabah Land Development Board, P O Box 359, Tawau, Sabah.

5597 Khoo Eng Min, Bukit Serampang Estate, P O Box 506, Tangkak, Johore.

5515 Lim Hua Son, Anak Kulim Estate, Kulim, Kedah.

4878 Lee Beng Huat, Windsor Estate, Taiping, Perak.

5116 Loh Kwan Peng, Chamek Estate, P O Box 505, Kluang, Johore.

4998 Leask, J C, Sungei Buloh Estate, Bukit Rotan, Selangor.

4750 Lee Lye Huat, Robert, Senawang Estate, Sungei Gadut, Negri Sembilan.

3549 McCulloch, G C, FISP, Torkington Estate, Sabak Bernam, Selangor.

4842 Mohd Ali bin Hj Ahmad, Sungei Mahang Estate, Nilai, Negri Sembilan.

5544 Menon, P Muralidhara, Narborough Estate, Sungkai, Perak.

5739 Menon, C S U, Bukit Badak Estate, Layang Layang, Johore.

5771 Mok Chak Khuin, Nicholas, Sabah Land Dev Board, Ranchangan Sungai Manila, P O Box 1253, Sandakan, Sabah.

5694 Murugesu, S, 13 Graeme Road, Sentul, Kuala Lumpur.

5564 Ng Siew Kee (Dr), Research Department, United Plantations Bhd., Teluk Anson, Perak.

5587 Ong Tat Teik, Johore Labis Estate, Cha'ah, Johore.

5352 Rajasingam, C, Klabang Estate, Chemor, Perak.

5494 Tsen Sui Lin, Anthony, BAL Estate Sdn Bhd, P O Box 135, Tawau, Sabah.

4789 Yap Thean Seng, Sungei Chinoh Estate, Trolak, Perak.

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Mutton Pasanda Badam

Ingredients

1 kati mutton

10 dried chillies or to taste

1 piece of ginger (about 2 in. long)

2 big onions

8 small onions

a few cardamons

½ teaspoon turmeric powder

salt to taste

3 tomatoes

1 lime

2 oz almonds

2 tablespoons oil

1–2 cups water

Method

Cut mutton into 1 inch cubes.

Grind dried chillies and half of the ginger.

Slice rest of the ginger, and the onions.

Crush cardamons with the side of a knife.

Cut tomatoes into 4.

Soak almonds in a cup of warm water for 5 mins and peel skin.

In a medium sized saucepan, heat the oil, fry the sliced ingredients and the cardamons.

When onions look glassy, add ground masala, turmeric powder and salt. Fry till fragrant.

Add mutton. Stir for a few minutes.

When meat is sealed add the water.

Bring to boil and continue cooking on low fire till meat is tender.

Add tomatoes and almonds.

Stir and cook until gravy is thick and remove from fire.

Just before serving add the lime juice and stir.

Serve with rice, chappati or pooris.

(*From* Miss J Viswanathan, Pasak Estate, Kota Tinggi.)

ADVERTISEMENT INDEX

OUR ADVERTISERS WOULD APPRECIATE KNOWING THAT YOU SAW IT IN "*THE PLANTER*" PLEASE MENTION "THE PLANTER" WHEN YOU WRITE

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They do do that.

You need the kind of help we can offer. Our experts know all the weeds here. And how to mix a chemical "cocktail" that'll knock them out cold. For a nice long time.

We have Shellapon to destroy sheet lalang and Shell Lalang Oil for effective eradication of sporadic lalang to the tips of their roots. Shell Amine 80 to wipe out broad-leafed weeds, (though not around oil palms!) Tenac to make sprays stick. Teepol to make sprays spread. Diurex 1000 and Shell MSMA to complete your "cocktail" cabinet.

There isn't a weed smarter than our herbicides.

Call us to advise you on the "cocktail" mixture for your estate that will be the most effective and the most economical.

Years of persecution have made weeds sneaky!

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Shell Lallang Oil: the quickest, surest way to wipe out sporadic lallang.

You can easily spot the live green lalang from the dead ones.

That's because every blade and stalk that has a touch of Shell Lalang Oil will begin to shrivel up and turn brown in 30 minutes. Then die within 3 days.

And lalang just wiped with the oil will positively glisten in sunlight. So there's no chance to wipe Shell Lalang Oil twice on the same lalang. There's no wastage. Supervision is easy because you'll know for sure, if any wiping has been done.

And that's how to wipe out the sporadic lalang menace. Quickly. Economically. Surely. And with minimum labour.

Talk it over with your Shell Chemicals man. He can give you all the details about Shell Lalang Oil.

And remember: if it's a chemical—or you think there may be a chemical to help you—call Shell Chemicals.

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