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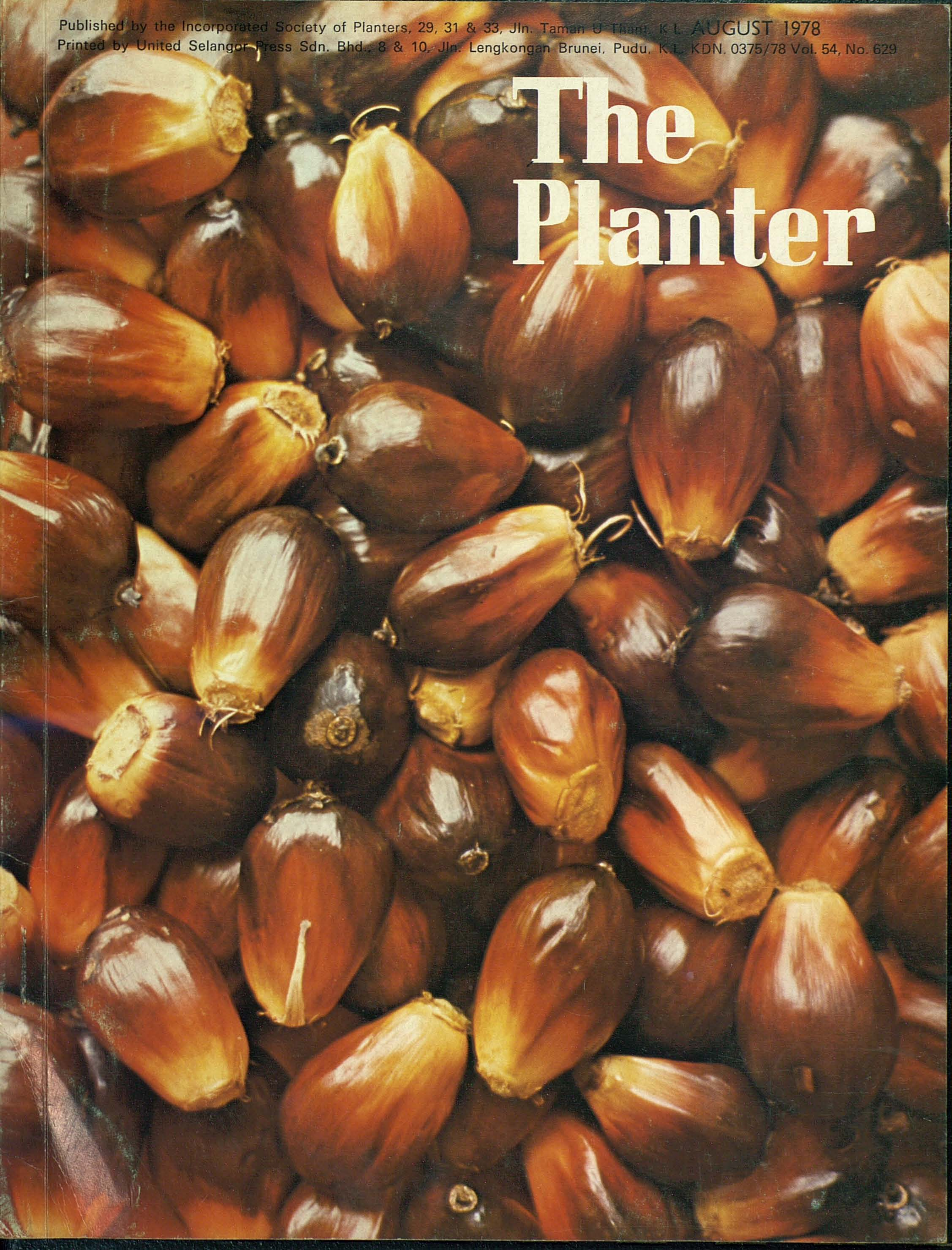
The Planter



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SENTIASA MAJU

The Incorporated Society of Planters

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:-

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

August 1978

Papers marked *Technical Article* in the text have been subject to evaluation by referees

The Planter

MAGAZINE OF THE INCORPORATED SOCIETY OF PLANTERS

(1) *The Planter* is published monthly from the Society's Office at No. 29, 31 & 33, Jalan Taman U Thant, Kuala Lumpur, Malaysia.

(2) It features original technical articles in tropical agriculture, for the benefit of the planter (in active service or practice), papers relating to the Society's Technical Education Scheme, and other contributions of more general interest.

(3) The magazine's current print order is 2 500 copies and this is steadily rising.

(4) *The Planter* is read in some 51 countries*.

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Editorial:

Another milestone

Malaysia's lead in the efficient production of good quality palm oil will need to be not only maintained but improved upon, if this commodity is to continue fully to play its important role in the economy of the nation. To this end, the Government has taken a major step in deciding to establish the Palm Oil Research Institute of Malaysia (PORIM), which is at the moment in the process of being set up and structured.

This institute will take over and extend the research functions hitherto carried out by MARDI, and will coordinate and complement the work of other private bodies which have thus far been responsible for much of the research that has made Malaysia not only the largest producer of palm oil, but also the leader in the field. The success of its expansion programme, the advances of its research and the quality of the international conferences on oil palm, all attest to this. PORIM will have, as one of its first tasks, the setting up of a Standard Malaysian Palm Oil Scheme, similar to that of the SMR for natural rubber.

The establishment of the Palm Oil Registration and Licencing Authority (PORLA) in advance of PORIM, was another timely and well considered move. Its first success in getting the Malaysian Palm Oil Producers' Association (MPOPA) and the Palm Oil Refiners' Association of Malaysia (PORAM) to agree to the supply of crude oil to the local refiners, speaks well for the need of such a body. The increased utilisation of the nation's refinery capacities from 38.03 per cent in 1975 to 70.84 per cent presently, and the expectation that the refinery capacities will be increased in the immediate future, show the scope for an authority to coordinate the efforts of these two bodies – MPOPA and PORAM. Another urgent priority for PORLA will be to look into the setting up of the Palm Oil Commodity Exchange (POCE).

Last August, the Primary Industries Minister announced the need to give priority for such an exchange. He had, in fact, obtained the services of the president of the Hongkong Commodity Exchange to look into this matter and to submit his recommendations on the organisation, form and structure of the proposed exchange, the type of clearing and guarantee institutions, the provisions for regulating and supervising future trading and suitable measures to attract both local and foreign participation.

With the increase in the world's population and the improvement in per capita consumption of oils and fats, the unrivalled efficiency of oil palm in volume of production from a given unit area of land stands it in good stead to compete even more successfully with other oils and fats. Its particular qualities make it increasingly a preferred commodity in this market. There

can be no question that the setting up of the above institutions and authorities by the Government is a step in the right direction to capitalise on achievement to date and consolidate this country's advantage.

Technical Article
Date received, September 23, 1978
Planter, Kuala Lumpur **54** : 461–474 (1978)

A collaborate study of uniform test methods for palm oil

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The results of a recent interlaboratory cross-check exercise on uniform test methods for some basic palm oil properties are presented. Much better agreement in test results among the participating laboratories was observed in respect of the determinations of free fatty acid (FFA), volatile matter, insoluble impurities and peroxide value of palm oil, as compared to the previous exercise where the participants were allowed to use their normal routine technique for analysis. The details of the proposed test methods are described.

This article is a follow-up to two earlier ones concerned with improving palm oil test methods. The first of these (Yeoh, 1977) was published in *The Planter* and reported an earlier interlaboratory cross-check study on the existing test methods for the determination of free fatty acid (FFA), volatile matter (VM), impurities, peroxide value (PV) and iodine value of palm oil by ten laboratories. In this, it was found that considerable disagreement in test results occurred among the participants, particularly in the analysis of % VM and impurities. These observed discrepancies were attributed to the different analytical procedures employed. Subsequently, a meeting of all the laboratory personnel involved was held, in March 1977, to assess the current methods for these palm oil testings, and to formulate common procedures for future round-robin studies. The detailed outcome of this meeting was reported in the second part (Yeoh & Chooi, 1977). The present paper reports a subsequent series of interlaboratory cross-checks on the application of uniform methods for the determination of FFA, VM, impurities and PV of crude palm oil, which was conducted in the following month.

COLLABORATIVE STUDY

Fifteen local laboratories took part in this exercise and each analysed 4 crude palm oil samples received from a central source† by the agreed test methods (see *Appendices I–IV*). Further comparisons were made to assess the merits of sample size in the proposed procedures for FFA analysis (3g and 5g samples) and for the determination of % insoluble impurities (20g and 40g samples). In addition, extra oil samples with high VM were separately examined.

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RESULTS AND DISCUSSION

The mean and spread of value found for each of the samples for the various properties are shown in *Tables 1–4.* Youden's (1963) ranking procedure has been used as in the previous studies to determine the reading consistency of each laboratory, and Dixon's (1953) criterion was applied whenever necessary to determine outliers.

Free fatty acid

Table 1 summarises the results of FFA determinations using 3g and 5g–wt sample sizes.

TABLE 1. FFA CONTENTS OF 4 PALM OIL SAMPLES DETERMINED BY THE PARTICIPATING LABORATORIES USING THE PROPOSED METHOD

	3g wt sample size				*5g wt sample size*			
	Sample A	*Sample B*	*Sample C*	*Sample D*	*Sample A*	*Sample B*	*Sample C*	*Sample D*
Mean	2.87	3.44	3.40	3.88	2.87	3.43	3.38	3.87
Std. Dev.	0.025	0.034	0.047	0.040	0.038	0.036	0.044	0.036
No. of Labs.*	10	12	11	10	13	14	14	13
Range	2.83 – 2.90	3.41 – 3.50	3.34 – 3.48	3.83 – 3.94	2.81 – 2.92	3.38 – 2.49	3.31 – 3.44	3.83 – 3.93
Outliers	2.77, 3.00	3.35, 3.61	3.22	3.79, 4.09	2.76, 2.96	3.33	3.22	3.77

*Labs with results rejected on the basis of 95% confidence on Dixon's (1953) and Youden's (1963) Criteria are not included.

The agreement in test results among laboratories was satisfactory with an interlaboratory standard deviation of 0.04% (as palmitic acid), among laboratories which met the requirements of Youden's ranking and Dixon's criterion for outliers. A few results were excluded on this basis, and in one case, the observed deviations were due to unfamilarity with the proposed test procedure (Chick, *personal communication*), which uses isopropyl alcohol as solvent and phenolphthalein as indicator because the laboratory concerned was more familiar in using denatured alcohol and thymol blue in the daily routine FFA analysis.

The previous cross-check exercise (Yeoh, 1977) was relatively satisfactory for FFA determinations, and the interlaboratory standard

deviation of 0.04% was obtained. This indicates that the method of FFA analysis is reliable generally. There did not appear to be any substantial difference in results between 3g and 5g–wt sample sizes used, but slightly better agreement was attained with the 5g–wt sample size. For this reason it is proposed that a 5g–wt sample be used for the determination of FFA in crude palm oil, to give better uniformity.

Volatile matter

The summarised cross-check results on the VM test by the participants are shown in *Table 2.*

TABLE 2. VOLATILE MATTER/MOISTURE CONTENTS OF 6 PALM OIL SAMPLES DETERMINED BY THE PARTICIPATING LABORATORIES USING THE PROPOSED METHOD

	Sample A	*Sample B*	*Sample C*	*Sample D*	*Sample E*	*Sample F*
Mean	0.07	0.09	0.09	0.07	0.12	0.19
Std. Dev.	0.016	0.020	0.017	0.016	0.011	0.017
No. of Labs.*	14	14	13	13	11	12
Range	0.04–0.09	0.06–0.13	0.07–0.12	0.05–0.10	0.10–0.14	0.16–0.21
Outliers	–	–	0.47	0.13	0.18	–

*Labs with results rejected on the basis of 95% confidence on Dixon's (1953) and Youden's (1963) Criteria are not included.

An interlaboratory standard deviation of around 0.033% in the determination of volatile matter/moisture content of crude palm oil was found in the last cross-check study (Yeoh, 1977), and it is noted that it has been reduced to 0.020% through an uniform test procedure. The difference were proportionately smaller at high VM levels.

The better test agreement in the proposed uniform method is probably due to the process of drying of oil continuously at 103°C for exactly 2½ hours, instead of the usual dry until constant weight procedure. This method has the time advantage and better reproducibility (Chin, 1977).

It is suggested that the observed interlaboratory differences in this exercise could have been even smaller if the temperature of the ovens used by the participants had been calibrated and standardised.

Insoluble impurities

Table 3 shows the collated results of palm oil dirt determination found by the various participants.

TABLE 3. IMPURITIES CONTENT OF 4 PALM OIL SAMPLES DETERMINED BY THE PARTICIPATING LABORATORIES USING THE PROPOSED UNIFORM METHOD

	20g wt sample				*40g wt sample*			
	Sample A	*Sample B*	*Sample C*	*Sample D*	*Sample A*	*Sample B*	*Sample C*	*Sample D*
Mean	0.020	0.022	0.020	0.012	0.020	0.024	0.021	0.011
Std. Dev.	0.003	0.004	0.004	0.004	0.005	0.003	0.005	0.003
No. of Labs.*	11	12	13	13	14	13	13	13
Range	0.015–0.024	0.015–0.028	0.015–0.027	0.006–0.016	0.013–0.028	0.019–0.030	0.014–0.028	0.006–0.016
Outliers	0.006, 0.011, 0.027	0.032, 0.040	0.014, 0.032	0.036	–	0.016	0.031	0.023

*Labs with results rejected on the basis of 95% confidence on Dixon's (1953) and Youden's (1963) Criteria are not included.

Although considerable improvement in the uniformity of results among laboratories (s.d. 0.004%) was observed here as compared with those in the previous study (average of ca. 0.007%) (Yeoh, 1977), it appears that there is still room for narrowing the interlaboratory difference. The variable test results were obviously due to the variable size of the suspended particles, and possibly to sampling error.

Two laboratories were found to often obtain far too low and high results and were excluded in the calculation of means by Youden's ranking procedure. The explanations to these abnormalities are not obvious, however.

It was also noted that comparative readings were found in the case with a 20g wt sample. An obvious explanation for this is that more dirt had to be filtered off in the 40g wt sample, and the chance was proportionately higher for bigger suspended particles to block the pores of the glass fibre paper before the smaller ones did. Hence, it is proposed that a 20g wt sample should be used in the determination of palm oil impurities.

Peroxide value

Twelve out of 15 laboratories reported their findings in the peroxide value determination, and the results are summarised in *Table 4*.

TABLE 4. PEROXIDE VALUES IN 4 PALM OIL SAMPLES DETERMINED BY THE PARTICIPATING LABORATORIES USING THE PROPOSED UNIFORM METHODS

	Sample A	*Sample B*	*Sample C*	*Sample D*
Mean	3.3	7.4	3.4	0.4
Std. Dev.	0.22	0.31	0.23	0.27
No. of Labs.*	9	10	11	12
Range	3.0–3.6	6.8–7.8	3.0–3.8	0–0.9
Outliers	1.4, 2.7, 4.1	4.6, 5.9	2.4	–

*Labs with results rejected on the basis of 95% confidence on Dixion's (1953) and Youden's (1963) Criteria are not included.

A few results was excluded by the Dixon's criterion for outliers, before determining the results statistically. It is felt that variations in temperature and period of heating during homogenising the palm oil samples probably contributed a major part of the observed interlaboratory differences.

A fairly constant standard deviation of about 0.25 meq 0_2/kg oil for the wide means between the range of 0.4 to 7.4 meq 0_2/kg was observed. This indicates that the proposed test method for the PV, determination of palm oil with carefully standardised heating conditions could be reliable.

CONCLUSION

A comparison of test results in this series of cross-checks with those reported previously (Yeoh, 1977) in which the participants used their own routine techniques, shows that a better agreement among laboratories on their test results could be achieved through uniform analytical procedures.

It must however be made clear that the proposed methods for FFA, volatile matter, impurities and peroxide value of palm oil are not new. They have been drafted by modifying the existing standard methods for oils and fats in general, so as to be most suitable for our local laboratory conditions.

The participating laboratories are of the opinion that these uniform test procedures should be adopted by all Malaysian palm oil testing laboratories to give more reliable results, and that frequently round-robin studies be conducted to monitor their reliability and reproducibility in test results. A sub-committee of the TRC of the Oil Palm Growers' Council (OPGC) has been set up to implement this.

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Appendix I

PROPOSED METHOD FOR THE DETERMINATION OF FREE FATTY ACID CONTENT OF PALM OIL

This method is based largely on the VOTC Test Method.

Preparation of samples

Melt the palm oil sample at 55–60°C and thoroughly homogenise it before sampling.

Apparatus

1. An ordinary 25 ml burette, with 0.1 ml subdivisions
2. Hot plate, with or without integral magnetic stirrer
3. Erlenmeyer flasks, 250 ml
4. Analytical balance, capable of weighing to 0.1 mg.

Reagents

1. Phenolphthalein solution, 1% w/v in 95% ethanol or thymol blue solution, 0.5% w/v in methanol
2. Potassium hydrogen phthalate AR. Dry at 120°C for 2 hours and allow to cool in desiccator
3. Sodium hydroxide or potassium hydroxide solution approx. 0.1N. Standardise with potassium hydrogen phthalate as follows:

   Weigh out 0.4 ± 0.02 gm to 0.1 gm of the dried potassium hydrogen phthalate directly into a conical flask. Add 50 ml water and phenolphthalein (or thymol blue) indicator. Place on the hot plate and stir or swirl gently at the boil until the salt has completely dissolved. Titrate the solution with the sodium hydroxide or potassium hydroxide to be standardised to the first appearance of a permanent pink or a yellow colour.

   Calculate the normality of alkali as

$$= \frac{w \times 1\,000}{t \times 204.2}$$

where w = weight of phthalate taken, t = volume of hydroxide in mls. Give the results to four decimal places. Make 3 determinations and take the mean value. The titer of NaOH or KOH should be checked at least once a week.

4. Iso-proparol, AR or not less than 95% w/v.

Procedure

1. Weigh 5 ± 0.5g of oil, to 0.001g, into a conical flask and add 50 ml of hot alcohol, which has been previously neutralised at the boil to phenolphthalein or thymol blue by dropwise addition of the hydroxide

2. Place the flask on the hot-plate and regulate this to allow the solution to boil gently, meanwhile stirring magnetically or swirling with sufficient vigour to keep the oil dispersed in small droplets

3. Add ca. 0.5 ml phenolphthalein or thymol blue indicator and titrate with standardised 0.1N NaOH or KOH solution, boiling and stirring or swirling continuously, until a pink end point (for phenolphthalein) or a khaki green colour (in the case of thymol blue), persisting for at least 30 sec. is reached.

Calculation

Acidity, or free fatty acid in the palm oil is calculated as palmitic acid from the formula

$$FFA\% = \frac{25.6 \times t \times N}{w}$$

where t = titre in mls, N = normality of hydroxide and w is the weight of oil used.

The result should be expressed to 2 decimal places.

Appendix II

PROPOSED METHOD FOR THE DETERMINATION OF VOLATILE MATTER IN PALM OIL

Preparation of sample

The test should be the first test to be performed on palm oil melted at ca. 55° C and thoroughly homogenised prior to sampling.

Apparatus

1. Electric oven (convectional) capable of continuously maintaining 105°C ± 2°C fitted with a suitable thermometer

2. Petri dishes, glass crystallising dishes, or beakers (250 ml), diameter 5.5 – 7 cm with covers

3. Desiccator with activated silica gel (self-indicating)

4. Analytical balance, capable of weighing to 0.1 mg

5. A top pan loading balance.

Procedure

1. Clean the dishes and covers, dry in the oven at 103°C for at least 15 minutes, and allow them to cool in the desiccator. Weigh the dishes plus cover

2. Weigh approximately 10g ± 1g of the molten oil into the dishes using a top pan loading balance

3. Return the dishes to the desiccator until the palm oil has thoroughly cooled. Weigh the dish plus cover plus cooled oil to 0.1 mg and place in the middle shelf of the oven at 103°C for exactly 2½ hours, without cover. The glass cover should be placed in the oven as well

4. Remove the dishes with cover on, allow to cool thoroughly in the desiccator for ½–1 hour before re-weighing.

Calculation

The volatile matter in palm oil is the mass lost on heating, expressed as a percentage of the mass of the oil, to 3 decimal places.

4. Iso-propanol, AR or not less than 95% w/v.

If P = weight of dish + cover
P^1 = weight of dish + oil + cover
and P^2 = weight of dish + oil after 2½ hours drying + cover,

$$\text{then \% volatile matter} = \frac{P^1 - P^2}{P^1 - P} \times 100$$

Note

1. The importance of the dishes being completely cooled to balance temperature is stressed since even small differences from this temperature can easily affect the precision and accuracy of weighing. Glass dishes take an appreciable time to cool especially if a large number are placed in the desiccator at the same time, and as much as one hour may be required for a full desiccator load to cool completely.

2. The performance of the oven must be checked periodically by placing a thermometer, giving correct indication of temperature (check in boiling water) in dish filled with the same amount of oil as the sample and placed at the same level in the oven.

3. The oven door must be kept closed during the entire test, neither should the ventilation hoods be operated, once the temperature of 103° has been established.

4. During the test, the oven should not be used for other purposes and therefore not opened for 2½ hours.

5. In the procedure it is convenient to transfer the dishes by hand using a clean cotton glove for protection.

Appendix III

PROPOSED METHOD FOR THE DETERMINATION OF INSOLUBLE IMPURITIES IN PALM OIL

Preparation of sample

Melt the palm oil sample at 55–60° C and homogenise it before sampling.

Apparatus

1. Porcelain gooch crucible, inside diameter ca. 20mm at the bottom
2. Whatman's glass fibre filter paper, GF/B
3. Electric oven at 103° ± 2° C
4. Desiccator with activated silica gel
5. Vacuum flask 1 litre, with adaptor and ring for gooch.

Reagents

Petroleum ether 60–80° C or hexane or redistilled shell-sol, filtered through a Whatman's No. 1 filter paper.

Procedure

1. Place a glass fibre filter paper on a gooch crucible
2. Wash with ca. 10 ml petroleum ether or hexane or shell-sol, dry at 103° C for 30 minutes, cool in the desiccator, and weigh to 0.1 mg
3. Weigh 20 gm to 0.01 gm in a conical flask 250 ml, add 100 ml solvent and swirl to achieve complete homogenisation. Leave for about 5 minutes until the insoluble matter has settled mainly, then pour off the solution with care into the gooch with known weight, by applying a slight vacuum. Use fresh solvent to transfer the total oil and insoluble matter on the gooch crucible and wash with several portions of 10 ml solvent until the totality of oil has been removed
4. Apply atmospheric pressure with caution, remove the crucible and wipe the outside with a clean tissue paper. Dry in oven at 103° C for 30 minutes and cool in desiccator to room temperature
5. Weigh the gooch crucible with the contents to 0.1 mg.

Calculation

The insoluble impurities of palm oil are calculated according to the deposite on the filter as % of the weight of oil, to the 3rd decimal.

If W = weight of sample taken, in grams
P = weight of gooch, in grams
and P^1 = weight of gooch plus impurities, in grams,

$$\text{then total impurities} = \frac{P^1 - P}{W} \times 100\%$$

Appendix IV

PROPOSED METHOD FOR THE DETERMINATION OF PEROXIDE VALUE OF PALM OIL

This method is based largely on the AOCS Official Method Cd 8–53.

Definition

This method determines substances, in terms of milli-equivalents of peroxide per 1 000 gm of sample, which oxidise KI under the conditions of the test. These are generally assumed to be peroxides or other similar products of fat oxidation.

Apparatus

1. Pipette, measuring tube, 1 ml capacity

2. Erlenmeyer flasks, 250 ml.

Reagents

1. Acetic acid – chloroform solution. Mix 3 parts by volume of glacial acetic acid with 2 parts by volume of chloroform

2. Potassium iodide solution.
   Saturated solution of KI; Analar grade, in recently boiled distilled water. Make sure the solution remains saturated as indicated by the presence of undissolved crystals. Store in the dark. Prepare fresh for each batch of analysis

3. Sodium thiosulphate solution of 0.1N, accurately standardised as follows:
   Weigh accurately ca. 0.8917g of potassium iodate previously dried at 120° C, dissolve in distilled water and dilute to 250 ml in a graduated flask. Transfer 25 ml to a 250 ml conical flask and add 1 ml saturated potassium iodide and 5 ml of 2N sulphuric acid. Titrate with the thiosulphate solution to a faint straw colour, add ca. .5 ml of starch solution and continue the titration to the end-point, which is from blue to colourless. Calculate the normality of thiosulphate solution as

$$\frac{0.8917 \times 25 \times 24}{214.0 \times t}$$

where to is the volume in ml of the thiosulphate solution used. Make 3 determinations and take the mean value.

4. Sodium thiosulphate solution, 0.01N, accurately standardised. This solution may be prepared by accurately pipetting 100 ml of the 0.1N thiosulphate solution into a 1 000 ml volumetric flask and diluting to volume with recently boiled distilled water.

5. Starch indicator solution, 1.0% of soluble starch in distilled water.

Preparation of crude palm oil samples

Apply the minimum amount of heat for the minimum time so that the sample can be adequately melted and homogenised before withdrawing a portion for analysis.

Procedure

1. Weigh 5.00 ± 0.05 gm of sample into a 250 ml conical flask and then add 25 ml–30 ml of the acetic acid – chloroform solution. Swirl the flask until the sample is dissolved in the solution. Add 0.5 ml of saturated KI with a measuring pipette

2. Swirl the reaction solution for exactly 1 minute and then add 50 ml of distilled water

3. Titrate with 0.01N sodium thiosulphate, adding it gradually and with constant and vigorous shaking. Continue the titration until the yellow colour has almost disappeared. Add ca. 0.5 ml of starch indicator solution. Continue the titration, shaking the flask vigorously near the end point to liberate all the iodine from the chloroform layer. Add the thiosulphate drop-wise until the blue colour has just disappeared.

Calculation

Peroxide value as milli-equivalents of peroxide per kg of sample

$$= \frac{S \times N \times 1\,000}{\text{wt of sample}}$$

Where S = titration of sample

N = normality of sodium thiosulphate solution.

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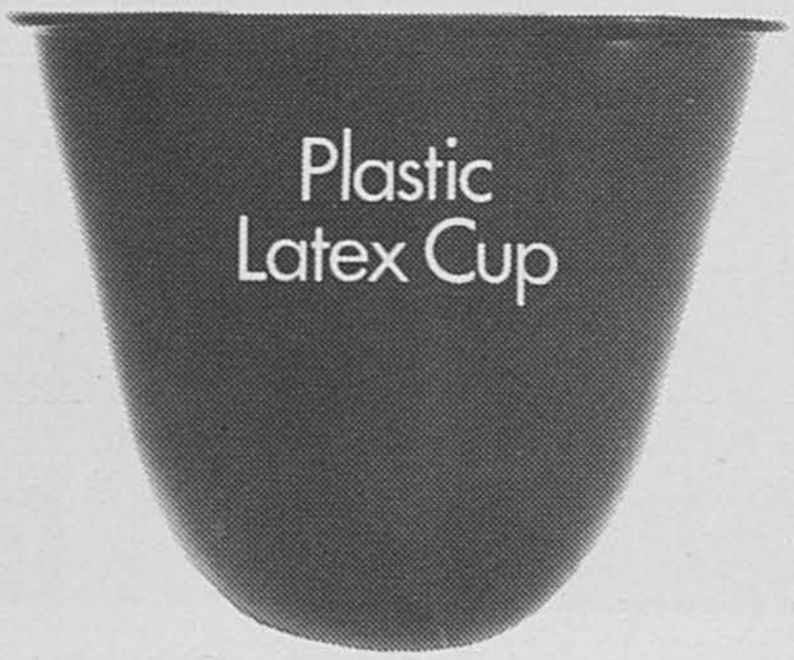

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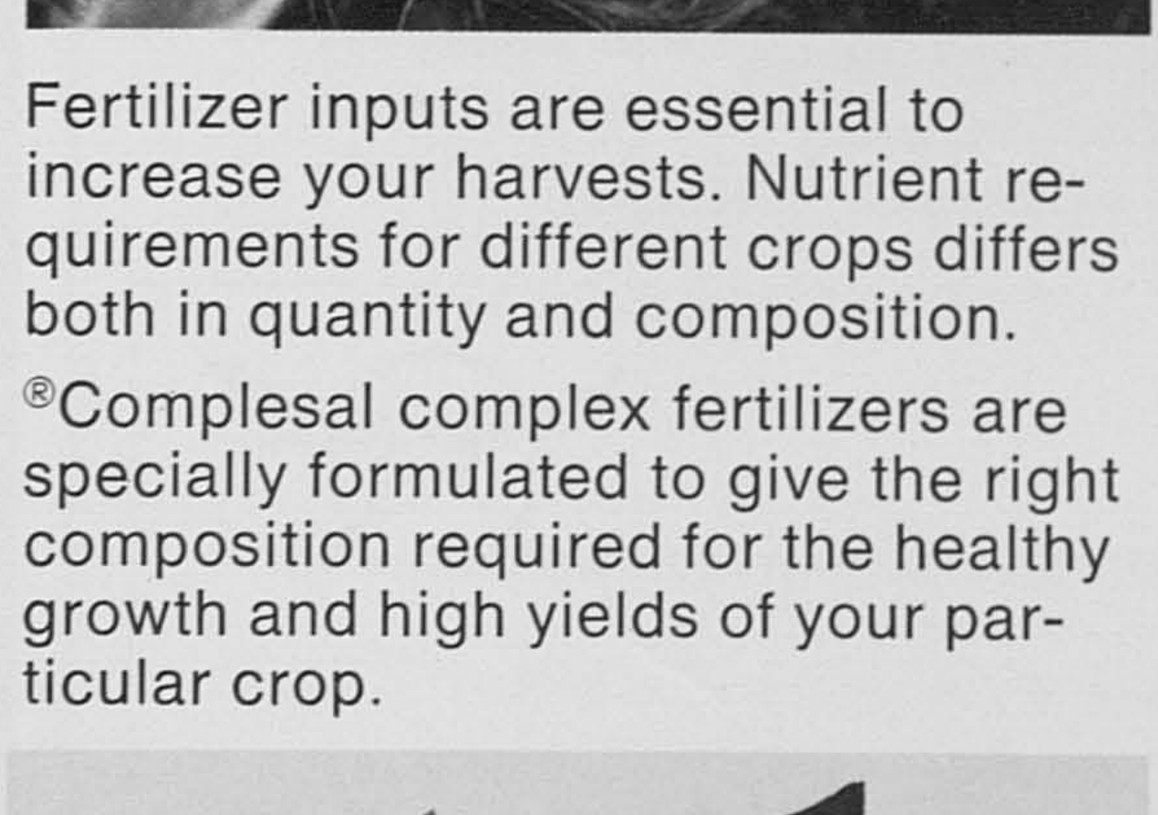

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Mechanical land clearing*

IBRAHIM BIN HAJI ISMAIL

Tractors Malaysia Berhad, Petaling Jaya

If a land clearing job is to be successful, it must be properly analysed and surveyed beforehand. Machines must be properly selected and equipped, operators must be trained and other personnel connected with the clearing work properly briefed. The job must be efficiently and properly managed throughout.

Vast acreages of land in Malaysia are still covered by dense, tropical jungle growth. The Malaysian government, in its effort to make the country self-sufficient in food, has recently launched the 'Green Book' which serves as a catalyst for all sectors to put in a more concerted effort in the implementation of various agricultural projects at federal, state or district levels. This in essence, is to spur and accelerate the opening and development of the so-called 'waste and unproductive land' for various agricultural projects and uses.

It can be deduced therefore that a greater role is to be played by both the public and private sectors in order to ensure the success of this grandiose plan.

Meeting this demand means two things: a faster rate of clearing the land and speedy development of it.

It is with the above aim in mind that this paper is prepared, outlining the mechanics of land clearing operation and the equipment used which have been proved successful in such projects as at Sungei Tekam, Pahang and Bukit Garam, Kinabatangan, Sabah. It is hoped that the paper will serve as an impetus to a more scientific approach to successful land clearing development programmes.

PRESENT CLEARING METHODS

To date nearly all land cleared in Malaysia has been cleared by manual methods. Manual clearing involves the employment of a large labour force armed with chainsaws, axes and other hand tools. This type of land clearing is not only out-moded in concept but also laborious and time-consuming (*Figure 1*).

Felled material is usually burned in place, with no attempt to windrow or pile. Burning in this manner involves a greater risk since success or failure is directly related to the amount of rainfall during the burning period. Once a partially burned area is extinguished by rain it is difficult to relight. There

*Paper presented at the ISP Conference on Estate Engineering & Mechanization 1975.

Figure 1. Manual land clearing using chainsaw

is also a time lapse of between 2–3 months before the downed materials are sufficiently dry to set alight. As a result anything up to 3 months potential use of the land is wasted.

When burning is completed in this manner, unburnt or partially charred stumps and ,tree trunks litter the area, and are left to decay naturally. Mechanization is employed only to remove standing stumps and repile the material for the second burn. Clearing land by this method is therefore most unsatisfactory.

A point to note is that mechanically windrowed material requires much less time to burn, due to its compactness.

THE NEED FOR MECHANIZATION

The need to go for full mechanized land clearing stems from the following:

- The tremendous pace of land development programmes. To meet this challenge full mechanization has to be introduced and adopted

- Through mechanized clearing, land development programmes can be predicted and controlled; work can be accelerated and adjusted to meet or suit the situation at the time

- Land can be cleared, prepared and developed at a faster rate. Thus a

greater acreage of unproductive land can be brought into use and more landless people given the opportunity to own land and be self-sufficient

- The end condition of land cleared mechanically is much improved since the area is free from charred logs, unburnt stumps, etc.
- The cleared land can be turned into productive use almost immediately
- There will be much less risk involved in attaining the desired results.

FACTORS AFFECTING MACHINE SELECTION

Selecting the biggest and most powerful machine, or the smallest machine and cheapest method, to clear land is not the right way to go about clearing land.

Each job must be evaluated separately. Only after assessing all the variables can one select the equipment and proceed with the actual clearing work. The major variables that must be considered include:

- End use of the land
- Vegetation
- Soil or underfoot conditions
- Topography
- Climate and rain
- Job specifications
- Time available
- Size of job.

(1) *End use of the land*

The end use of the land is a very important factor in making final equipment selection, and should be known right from the beginning. The end use of the land will in fact dictate to what degree the land should be cleared and prepared.

For example, land preparation for oil palm will be entirely different from that required for sugarcane or paddy.

(2) *Vegetation*

The vegetative growth of the area to be cleared will have a direct effect on the selection of machines, machine production and finally cost. The number of trees, tree sizes, tree species, root systems, vines and undergrowth, have all to be considered.

All these variables can be determined by a 'tree count', the procedure for which is as follows:

A straight path 328 ft long is cut through the vegetation. The number of trees lying within 16 ft of either side of the path are counted and recorded together with information such as diameters, densities (hard or soft wood), root system, presence of vines, undergrowth and underfoot conditions.

The 328 ft x 32 ft area will produce a sample of about a quarter acre, and should be repeated two or three times in each area where the size and type of vegetation changes significantly.

A point to note in conducting a tree count is that tree diameters should be measured at breast height. Where the tree has a buttress base, the diameter should be measured at the top of the buttress where the trunk begins to run straight.

The counting can be done by grouping trees in the following categories such as;

Tree diameter (ft)	<1	1–2	2–3	3–4	4–6	>6
Number of trees/acre						

(3) *Soil and underfoot conditions*

The soil and underfoot conditions will have direct bearing on the choice of equipment and the method of land clearing and preparation. Soft underfoot conditions will not be conducive to the use of heavier machines. It may not even be possible to put machines in swampy areas, so other alternatives have to be found.

Production will be reduced if machines often get bogged down in the mud. As a result, clearing costs will be increased considerably.

Soil conditions will not only directly influence undercarriage wear and traction, but also play an important part in how easily the timber can be cut or destumped.

(4) *Topography*

Grade and terrain of the area will have tremendous effect on the production performance of the machine, as will streams, swampy areas, ravines, embedded rocks, ant hills or any other unusual topographical features.

(5) *Climate and rain*

The amount of rainfall in the area will have the effect of slowing down clearing production and will also jeopardise the burning period. Rainfall figures for the particular area should be taken into consideration so that precautions can be taken in planning out work schedules and in calculating the number of machines required for the project. In good weather conditions work is carried out in the bad areas, such as close to streams and swamps; in bad weather conditions, the machine should be withdrawn and put to work on higher ground. In this way, there is no loss of production.

In anticipation of bad weather periods, an adequate drainage system should be planned and executed. Thus the machines may be able to work in the low-lying areas since the water table has been considerably reduced.

(6) *Job specifications*

Specifications will dictate the type of clearing which needs to be done. They also specify the completion dates not only for each phase of the project but also for the total project. The method of debris disposal will also be defined: whether complete burning is required or the unburnt material can be pushed into ravines, gullies, etc.

Specification will also indicate whether marketable timber can be extracted and sold.

Completion dates and the amount of clearing will dictate the size of the machines.

If stacking is required an additional number of machines will be needed. This will have a direct bearing on the overall cost per acre analysis.

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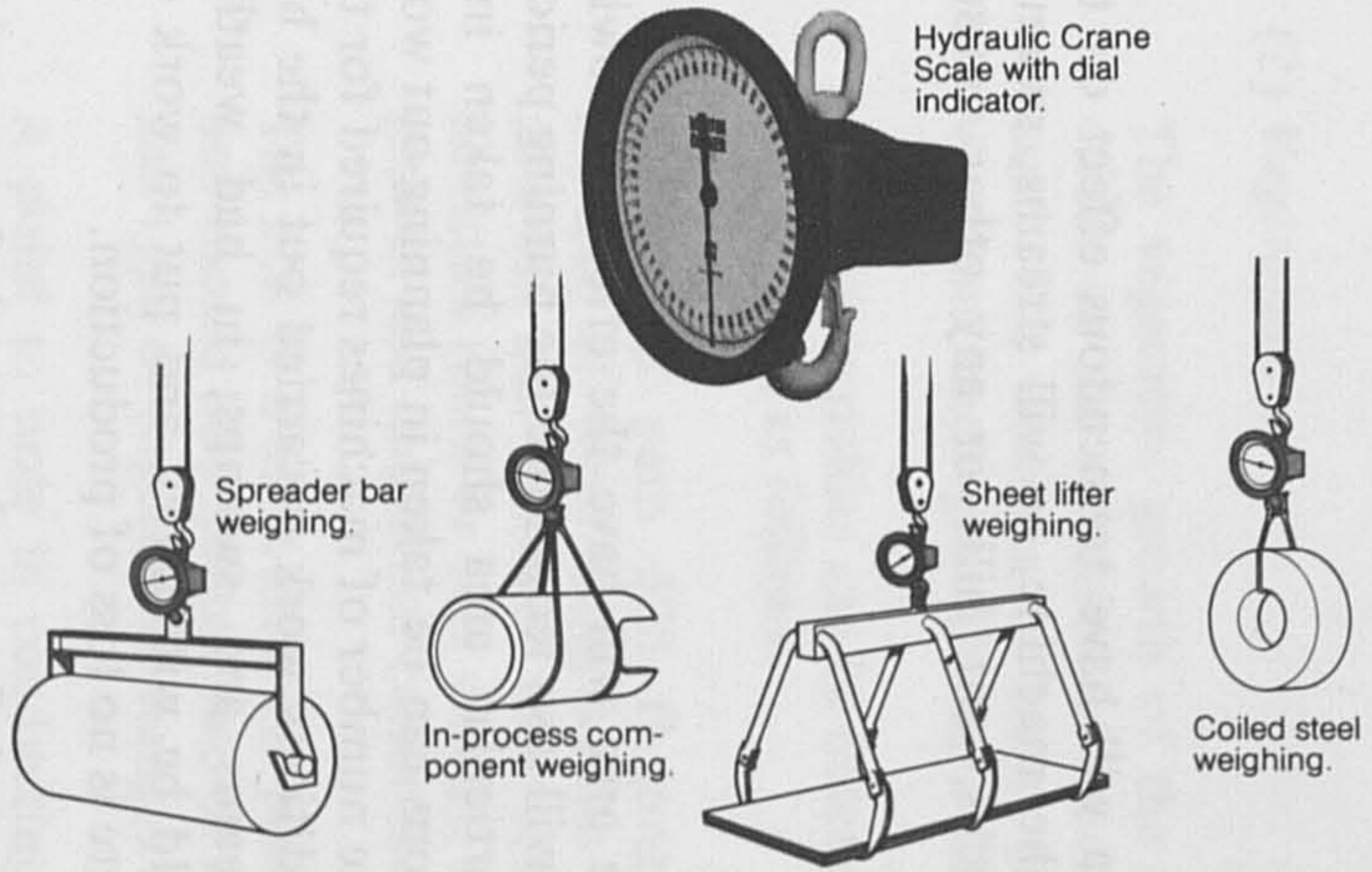

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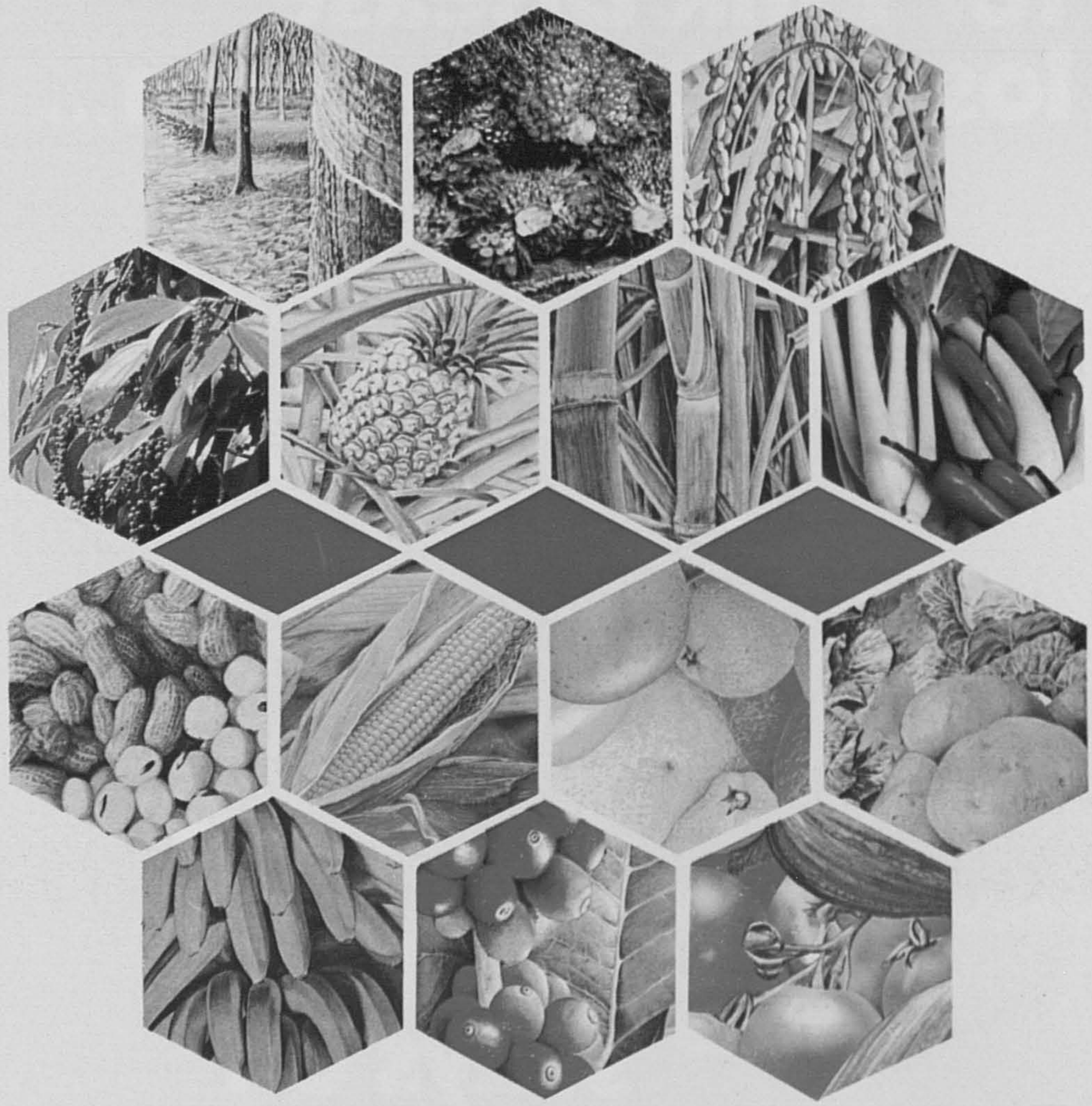

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The specifications should also indicate to what extent the area needs to be cleared and prepared; for example, is harrowing necessary? It should be borne in mind that specifications which require more than is actually needed, serve only to raise the cost per acre. On the other hand specifications must be clear, complete and concise, so that there will be no misunderstanding as to what is required.

(7) *Time available*

Before any recommendation is made, the completion date for the project needs to be known, since this will have a direct influence on the size and number of machines required. The number of working days per month and the number of hours per day need to be known and verified.

(8) *Project size*

Job size will dictate whether bigger machines or greater investment is justified.

In the development of a large-scale land clearing operation, it is uneconomical and impractical to employ a large fleet of small- to medium-size machines, where a lesser number of bigger machines can do the same amount of work, if not more. Furthermore, the employment of bigger machines will reduce the number of operators required to operate them.

LAND CLEARING EQUIPMENT

There is a very wide selection of land clearing equipment available in the market today. The methods adopted in clearing the jungle and the results obtained will be dictated by the equipment selected and used.

Equipment used in clearing operations in Malaysia today includes:-

1. *Chainsaws*

Chainsaws are generally used in felling both small and large standing timber. However, there is a distinct disadvantage in using this method in that large trees cannot be felled clean off the ground. As a result, stumps are generally left to rot or to be pushed over by bulldozers at a later stage. This method of clearing is most demanding both physically and mentally. The working group consists of a power-saw operator and one or two assistants. The later is used to carry equipment, clear undergrowth, debris and cut vines.

Burning of material felled this way is not efficient since the material is not piled together. Following, the burning, stumps, tree trunks will still litter the area.

2. *Bulldozer blade*

This is strictly a production blade to be used in dozing and side casting of material. The blade is not built for use in jungle clearing. Generally, even if used it is meant for small- to medium-size timber only. During tree felling, the earth around the base of the tree is dozed away thus exposing the roots. The roots are then cut with the cutting edge until the tree is sufficiently weakened to be pushed over completely. This type of felling is laborious and slow.

3. *Tree pusher*

This equipment is not meant for large trees, trees with tap roots or where traction is poor.

Small diameter trees cannot be removed by a tree pusher.

Each tree has to be individually handled.

The attachment applies the same leverage principle and is designed for toppling trees by reaching higher up the trunk to add the tree's top weight to the task.

4. *Rome KG clearing blade (Figure 2)*

This is by far the most versatile clearing tool available today. The same blade can cut, pile or stack, de-stump and ditch. It can fell trees of almost any size. KG blades are available for all models of Caterpillar crawler tractors from Cat D4D through Cat D9H. They are controlled by hydraulics and are mounted on Caterpillar or Rome C-Frames. The use of tilt cylinders improves the production performance of the machines, increases all round efficiency and will also reduce operator fatigue. The KG blade comprises the following components – stinger, web, cutting edge, mould-board and guide bar.

The stinger is a protruding knife running parallel and to the left of the tractor. It is approximately 12 inches ahead of the cutting edge. The cutting edge runs the full width of the KG blade and is used for shearing or cutting vegetation in one continuous action as the tractor moves forward. On the underside of the cutting edge there is a skid

plate. This serves to ride over the ground thus preventing the blade from digging into the ground as it cuts trees at ground level. The function of the guide bar is to protect the tractor and operator and to guide the cut material forward, to the right and away from the tractor. It is not however used as a pusher or knockdown beam.

Figure 2. Cat D8H tractor complete with Rome KG clearing blade

Finally, the stinger can be tilted down on the left and forward until the stinger digs into the ground. In this position the stinger can cut and remove roots below ground level.

5. *Rakes (Figure 3)*

Rakes are a useful tool in the stacking and restacking (burning) operations in any land clearing work. Basically, rakes are built with teeth or tines which can pick up fallen debris and pile it. The teeth are curved in order to give a rolling action to the material being moved. The openings between the teeth allow the soil to fall back to the ground instead of piling it up ahead of the rake.

The only disadvantage of the rake is that it does not work well in wet clay soils because of clogging in between the rake teeth. When this happens, the rake will act as a bulldozer blade in dozing dirt into the pile.

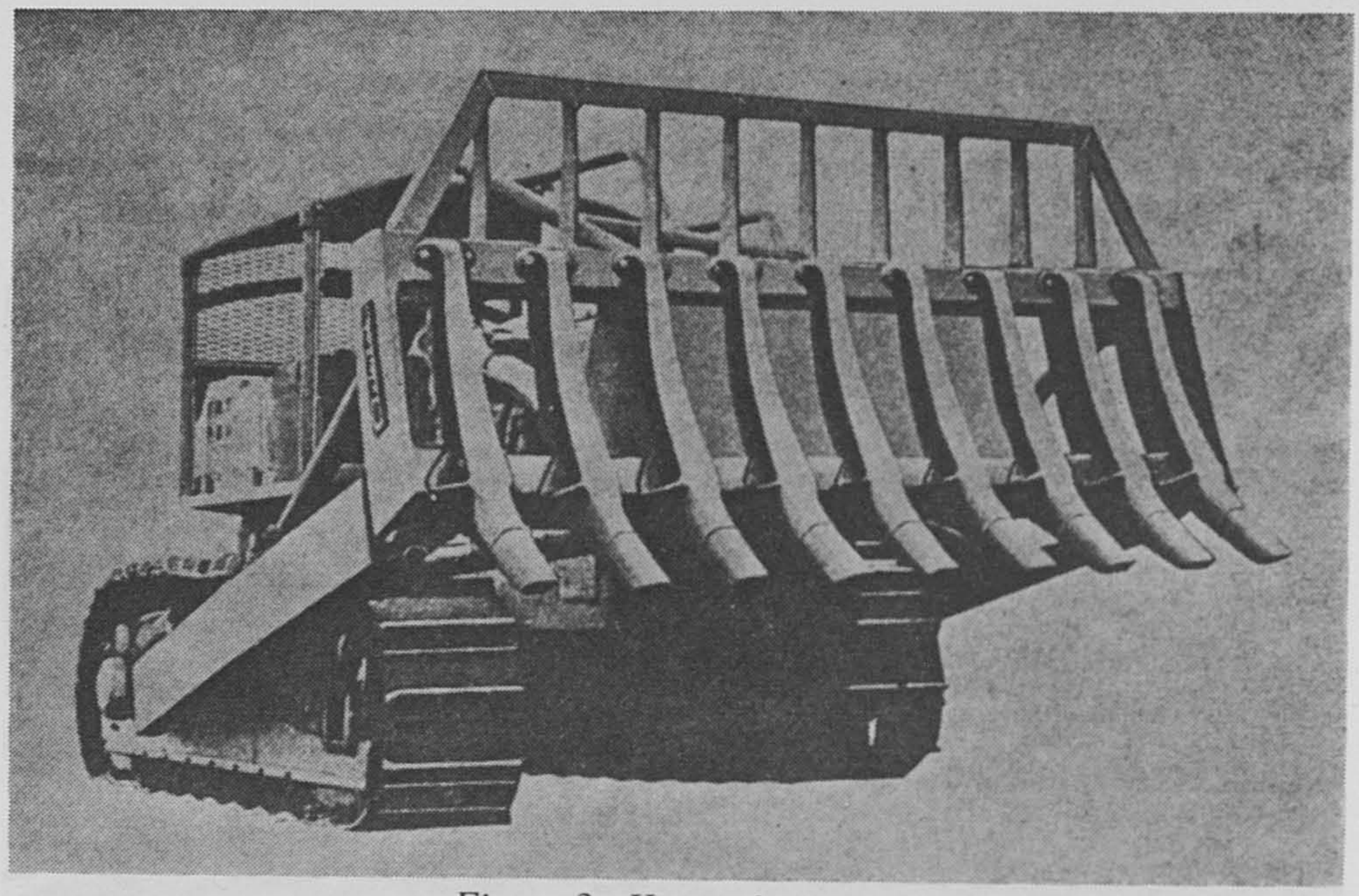


Figure 3. Heavy duty rake

There are a variety of rakes available for track type tractors. These rakes range from the MA (Multi-Application) rake for heavy duty land clearing – including tree and rock removal – to the brush and clean-up rake for final clean-up of small bits and pieces of material.

EQUIPPING LAND CLEARING MACHINES

The greatest mistake in any land clearing job is to employ poorly trained and inexperienced operators. And, neglecting to properly equip the machines for the job on hand can also mean disaster. It pays to incur additional costs in order to protect the operators and machines. The end results obtained from working a properly equipped machine are numerous, but to note a few:

(1) Operator feels secure, thus enabling him to work efficiently

(2) Operator has confidence in the machine

(3) Less risk in damaging the machine if properly equipped

(4) Operator's comfort

(5) Protection for the owner from any serious liability which may arise as a result of accident.

For land clearing work the following machine configuration is generally recommended:

(1) Heavy duty canopy

(2) Trash guard

(3) Radiator guard

(4) Front pull hook

(5) Crankcase guard

(6) Blower fan

(7) Lighting system

(8) Took kit

(9) Steel final drive cases

(10) Rome KG blade – (can be regarded as standard)

(11) Powershift units – (always).

Even with the existing standard attachments available on the land clearing machines, the machines are still regarded as inadequate or even unsafe to put to work. The following additional attachments are therefore recommended and should be seriously considered.

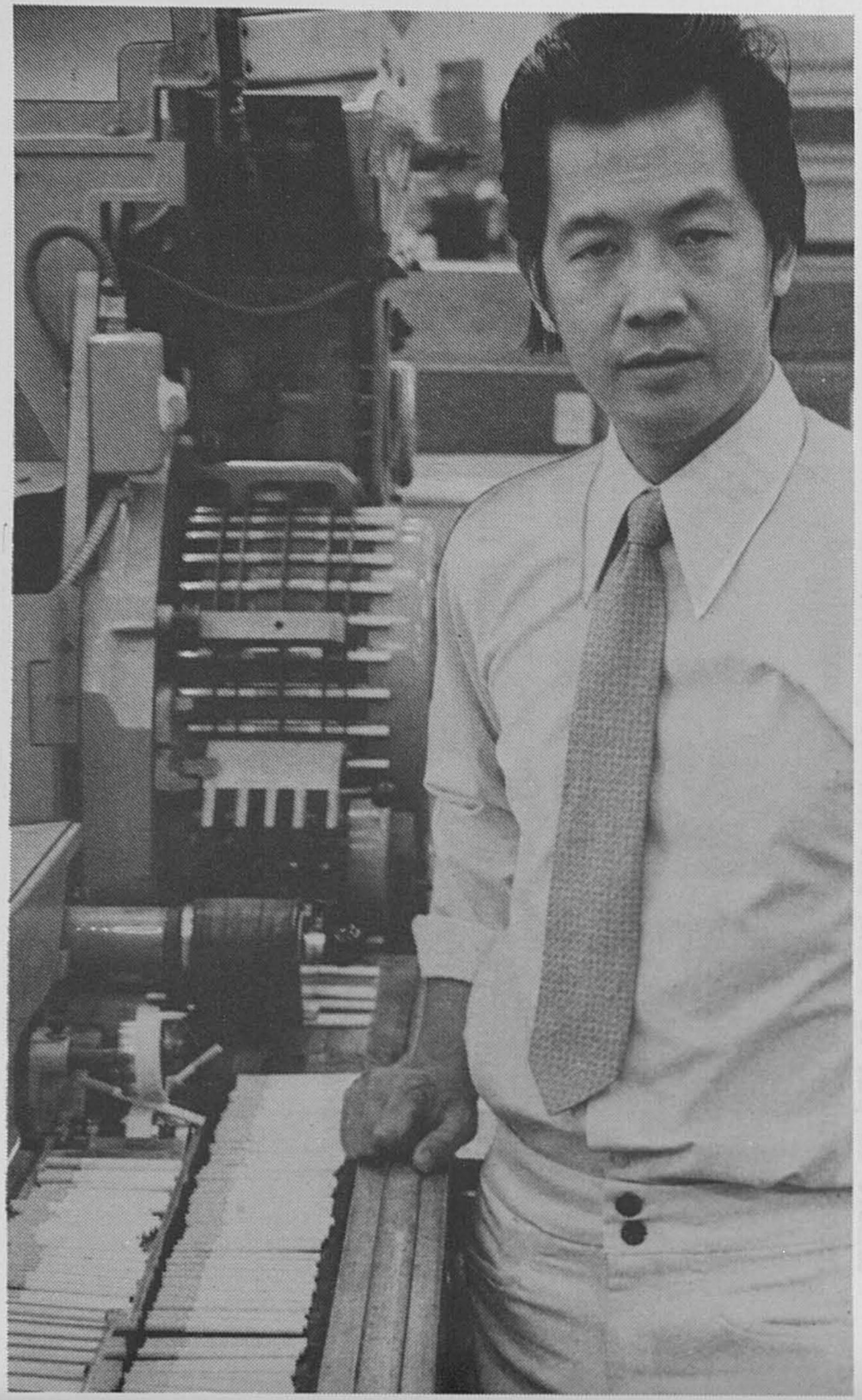
Recommended additional attachments:

(a) *Track guiding guards*

are desirable to maintain proper track alignment especially when working in hilly areas. This also prevents track slippage and extends track life. The guard also reduces roller flange wear, idler, track and sprocket scuffing.

(b) *Track roller guards*

to give protection to rollers when working in rough rocky and hilly areas.



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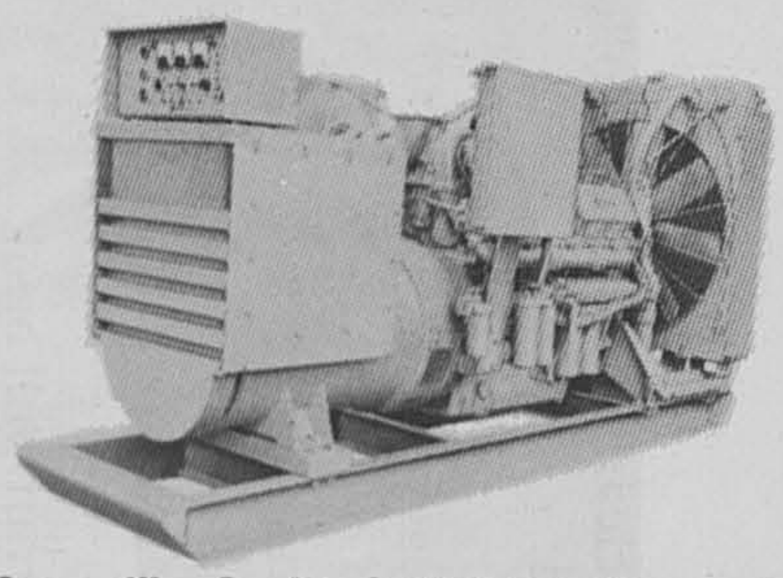

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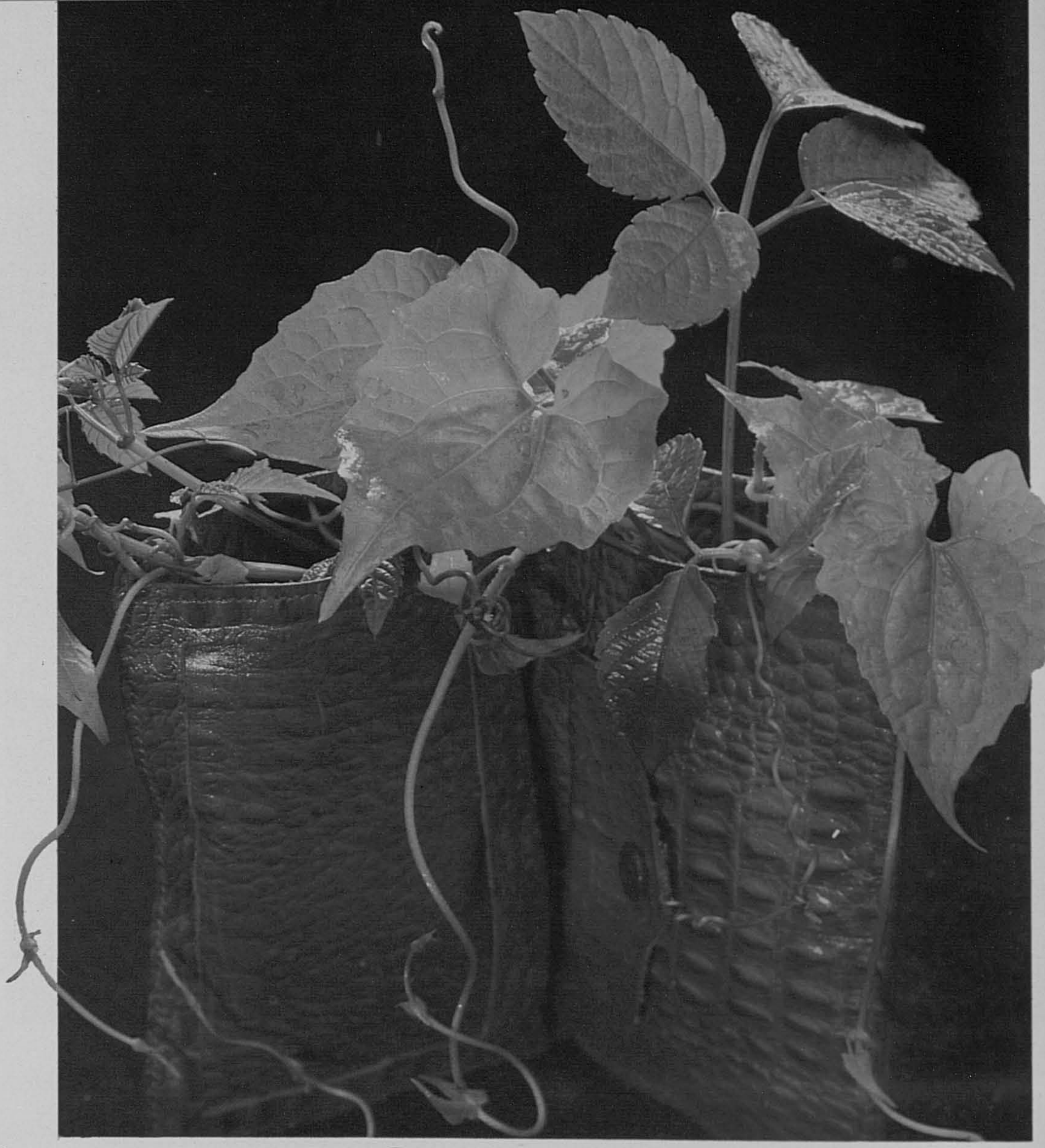

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* * Test results presented by RRIM at the 1976 Planters Conference show a cost savings of $323 per hectare using Dalapon compared to Glyphosate.

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(c) *Precleaner*

provides cleaner air to be supplied to the engine by trapping all dirt and coarse particles inside the plastic bowl.

(d) *Hydraulic cylinder guard*

protects the cylinders from falling tree limbs, etc.

(e) *Tank guard*

protects fuel tank from falling trees or branches.

(f) *Perforated engine side guards*

provide increased area for air flow and can be easily cleaned of trash. Doors in the engine side guards give access for engine servicing.

(g) *Winch*

to be used for pulling out tractors from boggy areas, removing stumps, winching logs from creeks, etc. Generally, at least one of the clearing tractors should be equipped with a winch.

(h) *Fire extinguisher*

to put out small fires caused by clogging of leaves, trash, etc. in the engine compartment, thus preventing heavy damage to the machine.

(i) *Tilt cylinder*

tilt cylinder on the KG blade provides more efficient operation of the blade.

(j) *7 Roller*

The tractor for land clearing should be fitted with a 7 roller frame. This is especially important when working in rolling or hilly areas and in poor underfoot conditions, there being greater ground contact area.

(k) *Rain cap*

to keep rain and trash out of the exhaust pipe.

(l) *Grinder*

for use in grinding or sharpening the Rome KG balde. A portable grinder is recommended for easy operation in the woods.

PLANNING FOR LAND CLEARING OPERATIONS

Prior to carrying out any land clearing operation, proper and adequate planning must be prepared well in advance. This will avoid any confusion and delay at the later stage of the operation. By taking this precaution it will also eliminate areas of uncertainty and thus all phases of the work can run smoothly according to schedule. The end result will be top machine performance with an all round high efficiency achieved.

Factors to consider in planning are:

(1) Transport and communications between field office and house office and within the work area.

(2) Service, maintenance and availability of spare parts.

(3) Related operations–

(a) Access roads

(b) Drainage and canals

(c) Logging operations, if any

(d) Demarcation of boundaries

(e) Others.

METHODS AND TECHNIQUES OF LAND CLEARING AND PREPARATION

Basically there are four distinct phases of operations to be considered in any mechanical land clearing. They are:

(1) Felling

(2) Windrowing, piling or stacking

(3) Restacking or repiling in burning

(4) Land preparation.

(1) *Felling trees and bush*

Here again there are two ways of felling trees:

(a) Felling up to ground level and

(b) destumping or felling trees together with the roots in one operation.

These two methods of felling can be easily achieved with the same Rome KG clearing blade. All that is needed to achieve the desired results is to adjust the blade angle. It is now possible to adjust the angle of the blade without the need for the operator to get off the tractor as was the case in the past. Adjustment can now be achieved by installing a hydraulic tilt cylinder on the right side of the brace arm assembly of the blade.

(i) *Felling up to ground level*

Essentially, in this type of operation, the first thing to do is to slice the tree trunk with the stinger until the tree is sufficiently weakened to be pushed over completely with either the stinger or the cutting edge. The presence of the guide bar helps the operator to control the direction of the falling trees. Smaller diameter trees are easily sheared with the cutting edge.

Tree stumps are at first split with the stinger before being finally sheared off to ground level, thus leaving a smooth, clean area (*Figure 4*).

The advantage in using a powershift machine is clearly seen here.

The machine is capable of making a repeated attack or charge at the tree without stopping and can change direction of travel almost instantaneously thus avoiding any unnecessary delay. Operator fatigue is minimised.

Figure 4. Felling with Rome KG blade

(ii) *Destumping*

Prior to any destumping operation, the Rome KG blade needs to be adjusted in such a position that the stinger will be tilted downward and forward. In this position the stinger is made to make a repeated penetrating cut at the base of the tree, in order to cut or slice the root system to sufficiently weaken the tree before pushing it over with the stinger. If necessary, the tree trunk is also chipped or sliced off with the stinger.

Felling in this way enables a greater amount or major part of the root system to be removed. An additional advantage obtained from destumping is that it makes it easier to burn since the trees and roots are shredded into bits and pieces.

Generally speaking, felling by using KG blade can be easily accomplished within a matter of a few minutes or even seconds irrespective of whether the trees are big or small.

Sharpening of Rome KG blade

One important aspect of mechanical clearing with the Rome KG blade is the need to sharpen the blade daily. This can be easily done at the end of each day's operation. Sharpening of the blade is essential especially during the felling operation, for the cutting

edge and stinger are used either to cut or shear the tree. However, during the stacking and restacking (repiling) operations, sharpening of the blade is not essential.

(2) *Windrowing, piling or stacking*

In this operation, felled timbers are pushed or piled into a windrow towards the centre or to one side of the cut area with one or more tractors working in formation. Squadron stacking affords better results when burning, since the material is piled high, that is, to about 15 feet and in a compact manner (when Cat D8's are used).

Generally speaking, the distance between windrows is between 100 and 200 feet. The windrows should be parallel but may be formed in any length.

Another advantage obtained from squadron stacking, is that greater amounts of material can be moved in one pass (*Figure 5*).

Figure 5. Squadron stacking using three tractors

Felled material is normally left on the ground for at least one week during a period of good weather before stacking is attempted. This is to enable the material to be sufficiently dried. However, it is important to note that felled material should not be left in an unstacked situation for any considerable length of time in view of the fact that later on when stacking is attempted a large amount of

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leaves or small bush essential for good burning tends to be left behind.

One important advantage in using the Rome KG blade in the stacking operation is that the stinger can be used to partially lift the vegetation, making it easier to push, because of the floating and lifting action of the blade due to the presence of the skid plate on the underside of the blade; very little dirt is carried to the pile with the vegetation. This facilitates burning.

(3a) *Disposal–burning trees and bush*

Burning of stacked material can be successfully achieved after the material has been down for at least a month. Periods of unstable weather conditions should be avoided, at least one week's continuously dry weather being necessary before the actual burning takes place.

Manual labourers are required to start the fires. Diesel is used to facilitate burning of the windrows. Lighted diesel-soaked rags are pushed deep into the windrows at closely spaced intervals of approximately 30–50 feet to ensure a good burn. Additionally, both sides of the windrows are lit at the same time. Windrows should be lit from the downwind side (*Figure 6*). Ideally, the windrows are set alight in the morning. By noon the hot sun will help to generate more heat and, by late afternoon tractors are sent to restack the burning windrows just before retiring for the day. In this way the fires are kept burning right through the night.

Figure 6. Lighting the windrows approximately three weeks after felling

After the initial burning, repiling should start as soon as the heat has subsided. Crawler tractors used in the repiling operation should be equipped with a blower fan. The fan will help not only to keep the dust away from the operator but also to rekindle the fires. The tractors must be provided with fire extinguishers to put out small fires caused by lighted flying leaves and trash.

Windrows are cut to smaller segments as soon as possible. This will help the piles to burn better and when one pile has lost most of its heat, it should be pushed to another pile to maintain the greatest possible concentration of heat, thus complete burning can be achieved much faster (*Figure 7*).

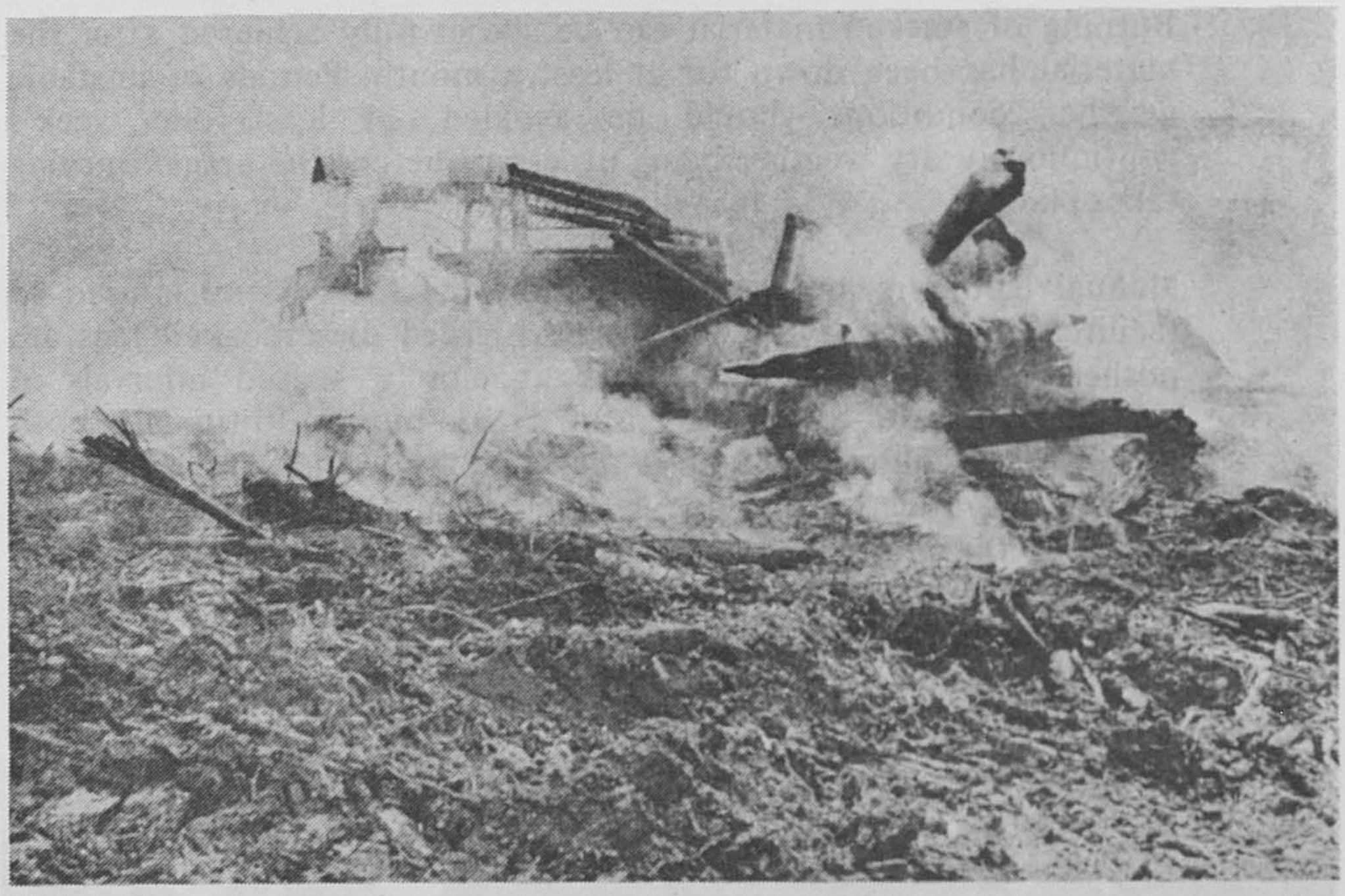


Figure 7. Restacking using track-type tractor

(3b) *Final clean-up*

Regardless of the method of felling and disposal used in clearing the land, loose pieces of stumps, roots and limbs will be still left on the ground. The cheapest and most practical method to dispose of this material is to pick up by hand and pile before burning.

(4) *Land preparation*

Depending on the end use of the land, the land can be prepared in different ways to suit a particular crop requirement.

The objectives in land preparation are:

(a) To loosen and break up the soil in order to increase aeration and infiltration of water

(b) To prepare a seedbed of suitable tilth for the crop to be grown

(c) To destroy and prevent weeds.

The whole premise of high-yield crop production is based on the stirring of the soil to provide a well-pulverised seedbed.

Generally speaking in any land preparation work, immediately after the land has been cleared and successfully burnt, a heavy duty hinge type offset disc harrow is brought in to cut through heavy vegetation and litter, tearing up roots and stumps as it goes. If a second harrowing is required, the area is normally cross harrowed.

Subsoiling or ripping after harrowing will eliminate trash clogging, breaking up deep-seated roots, and will aid root penetration and decrease water run-off. The subsoiler is capable of penetrating up to 36 inches deep. Roots, trash, litter, etc., are collected manually and piled before being burnt to ashes.

The next stage of the operation is to prepare for seedbed preparation, using disc harrows as shown in *Figure 8.* This will have the effect of pulverising and smoothening the soil after deep tillage. A land plane or leveller can also be introduced to level the area and to fill in ruttings in the soil.

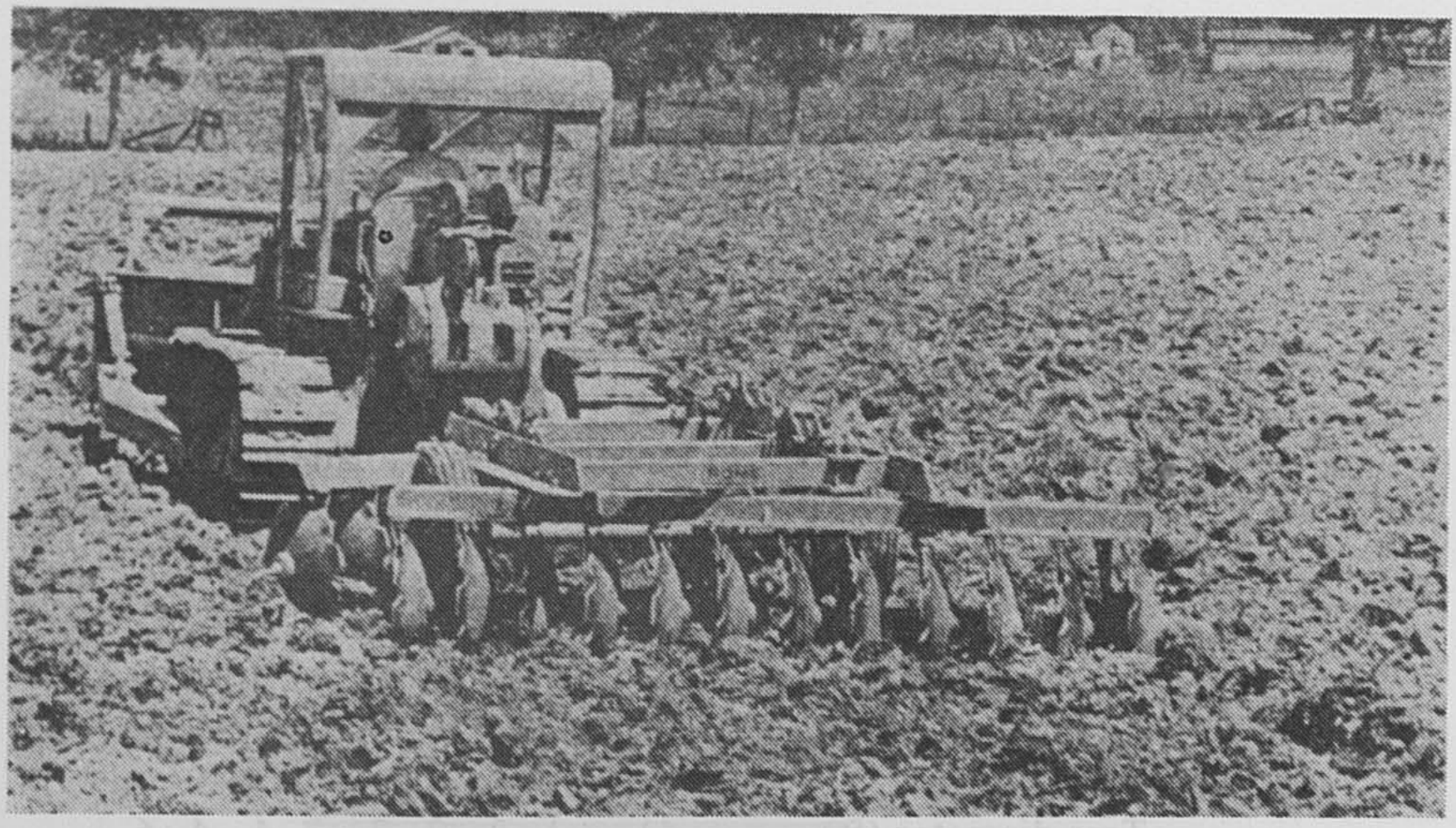


Figure 8. Harrowing using Rome disc harrows

Furrowing or bedding will complete the seedbed preparation. Crowder wings are attached to the subsoiler for this operation. The number of wings used will depend on the soil conditions and the size of the special application tractor used.

RECORD KEEPING AND PRODUCTION DETERMINATION

Accurate repair, maintenance and production records should be kept on a daily basis. Information such as hours worked, fuel and lubricants consumed, service required, repairs made, type of work performed and estimated acreage completed, should be recorded. Any miscellaneous factors affecting production or efficiency should also be recorded.

By having this information, production rates achieved and cost incurred by individual machines in each clearing operation can be determined.

PRODUCTION AND COST CALCULATIONS

A comparative machine performance calculations shown below, in terms of predicted versus actual production rates achieved as experienced in a land clearing project undertaken by Tractors Malaysia Berhad at Sungei Tekam, Pahang in 1968 will serve to illustrate different costs developed in each of the land clearing operation. And in order to make these costs more realistic to the present time, current machine costs are therefore being used. Machines hourly owning and operating costs were calculated using the machines delivered price (See pages 497 and 498).

The cost per acre developed includes the total of ownership, operating and repair costs, operator's and mechanics' time; but excludes margin for profit, overhead, transport, supplies, accomodation or other additional expense items. For an accurate assessment of total cost, these would have to be added to the cost per acre figure thus obtained.

JOB CONDITIONS

(1)	Location	–	Sungei Tekam, Pahang
(2)	Total acreage to be cleared	–	150
(3)	Time available for job (months)	–	3
(4)	Time available in hours/ year/tractor	–	2 250
(5)	Tree counts:		
	Tree diameter (ft)	–	<1 1–2 2–3 3–4 4–6

	No. of trees/acre	–	816	75	12	1	1
	% hardwoods	–	45	75	100	100	100
	Vines present	–	Yes	Yes	Yes	Yes	Yes
(6)	Description of root system	–	lateral, larger diameter all buttress				
(7)	Description of under-growth	–	dense				
(8)	Description of soil	–	clayey sand, slightly lateritic				
(9)	End use of land	–	Oil Palm Research Station				
(10)	Debris disposal method	–	windrow and burn				
(11)	Grade and terrain	–	+ 6% rolling				
(12)	Water table conditions	–	variables				
(13)	Rainfall	–	96 inches/year				
(14)	Underfoot conditions	–	good				
(15)	Machine	–	Cat D8H c/w Rome KG blade				

ESTIMATED PRODUCTION RATES

To estimate tractor felling rate the following formula was applied.

$$T = X\ (A(B) + MINI + M2N2 + M3N3 + M6N4)$$

where;

T = Time per acre in minutes
X = Hardwood or density factor affecting total time
A = Density or vines presence factor affecting base time
B = Base time for each tractor per acre
M = Minutes per tree in each diameter range
N = Number of trees per acre in each diameter range

Felling

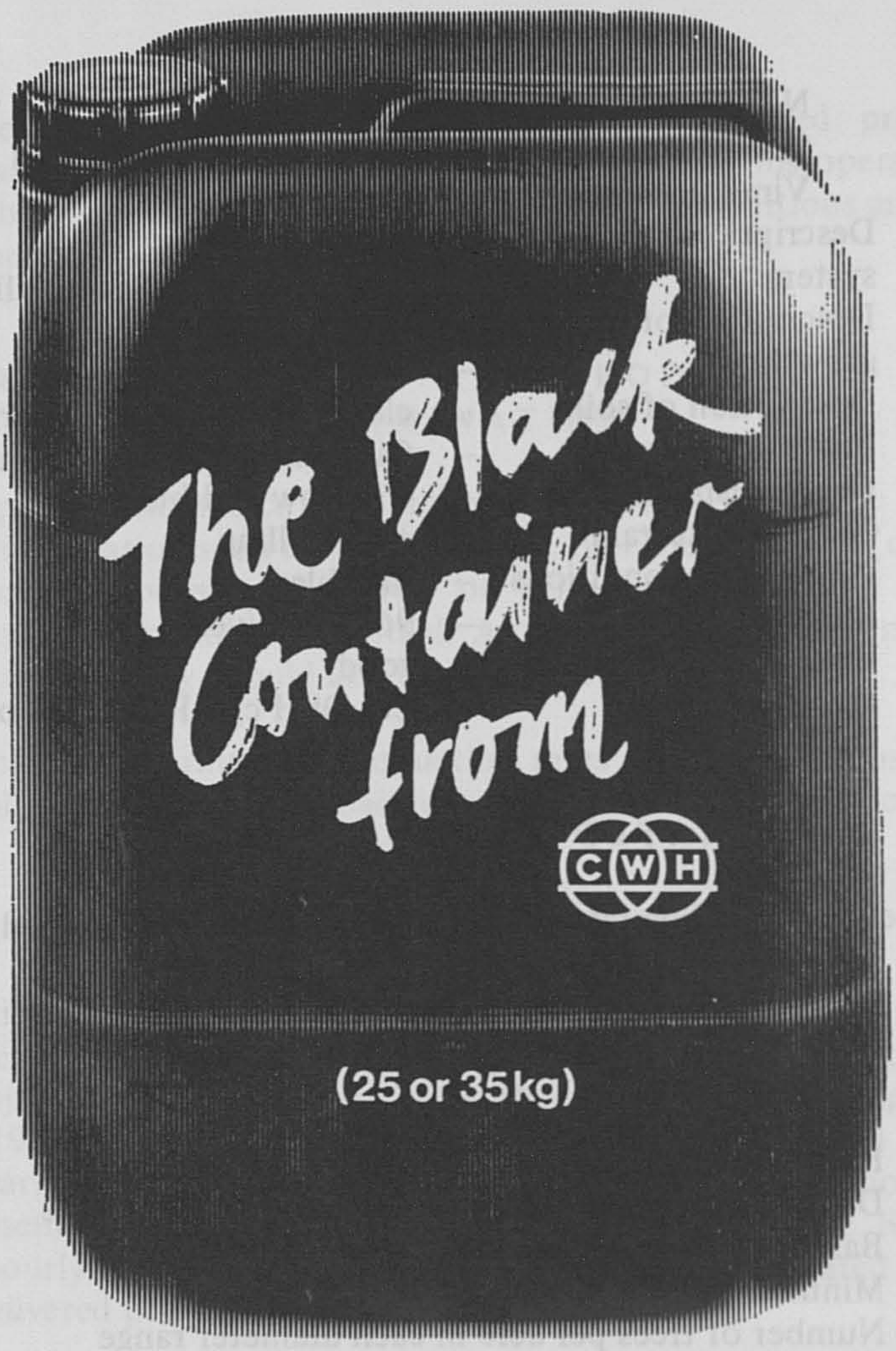
D8–T = 1.3 (2(21) + 0.3 x 75 + 1.5 x 12 + 2.5) x 1 + 7 x 1
= 1.3 (42 + 22.5 + 18 + 2.5 + 7)
= 1.3 (92)
= 119.3 min/acre or 0.502 acres/hour

Stacking

D8–T = 50 + 0.2 x 75 + 0.6 x 12 + 2 x 1 + 4 x 1
= 50 + 15 + 7.2 + 2 + 4
= 78.2 min/acre or 0.767 acre/hour

Burning (restacking)

D8–T estimated at 1.205 acres/hour



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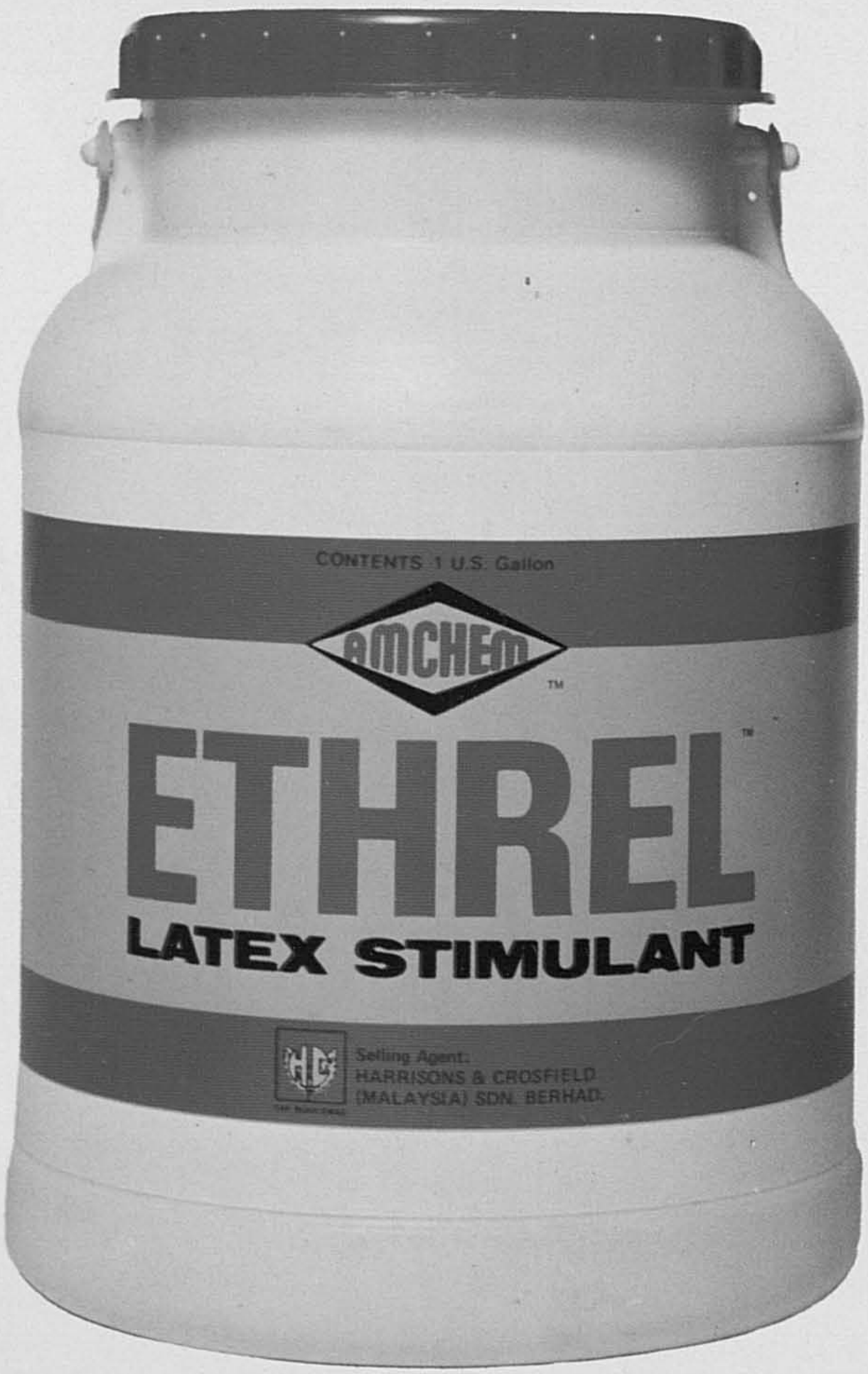

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PERFORMANCE COMPARISON

Operation	*Predicted rate D8H (ac/hr)*	*Actual rate achieved D8H (ac/hr)*	*Predicted rate D8K (ac/hr)**
Felling	0.502	0.433	0.481
Stacking	0.767	0.597	0.663
Restacking	1.205	0.873	0.97

*D8K has approximately 11.1% production advantage over the former D8H. The predicted production rate for the Cat D8K was obtained based on the actual rate achieved by the Cat D8H.

COST ANALYSIS

Costs developed are based on current machine prices.

Machines hourly owning and operating costs:

Cat D8K/KG	@	$75.85 x 2	=	$151.70
Cat D8K/KG/W	@	81.81 x 1	=	81.81
		Total		$233.51
Therefore, average hourly D8K			=	$ 77.84

Predicted rate – D8H

Operation	*Production rate*	*Hourly O & O*	*Cost/ac*
Felling	0.502	$77.84	$155.06
Stacking	0.767	77.84	101.49
Restacking	1.205	77.84	64.60
		Overall cost/ac	$321.15

Actual rate – D8H

Operation	*Production rate*	*Hourly O & O*	*Cost/ac*
Felling	0.433	$77.84	$179.77
Stacking	0.597	77.84	130.38
Restacking	0.873	77.84	89.16
		Overall cost/ac	$399.31

Predicted rate – D8K

Operation	*Production rate*	*Hourly O & O*	*Cost/ac*
Felling	0.481	$77.84	$161.83
Stacking	0.663	77.84	117.40
Restacking	0.97	77.84	80.25
		Overall cost/ac	$359.48

The reduction in overall cost per acre of the D8K over D8H is due to the increase in horsepower and improved productivity. The above costs per acre developed exclude other operational and overhead costs. Finally, the cost per acre of clearing the land will vary depending on the job location, conditions, equipment used and supervision.

CONCLUSION

The techniques of clearing land mentioned in this paper may not be the only method which will clear the jungle but will serve to illustrate that with proper understanding of the job conditions, the correct type of equipment selected, used and managed then there is no reason why any land clearing operation to be undertaken should not be done successfully and profitably.

REFERENCE

LAND CLEARING (1970) Caterpillar Tractor Company.

ESTIMATED HOURLY OWNING AND OPERATING COSTS

Date:

Machine designation: Caterpillar D8K PS/Rome KG Brade/Winch

Depreciation value:

1.	Delivered price (incl. attachments)	$391 000
2.	Tyre replacement costs:	
	Front	
	Drive	
	Rear	$
3.	Delivered price less tyre	$
4.	Less resale or trade-in value (optional) 20%	$ 78 200
5.	Nett value for depreciation	$312 800

Owning costs:

6. Depreciation: $\frac{\text{Nett depreciation value (item 5)}}{\text{Depreciation period in hours}}$

$\frac{\text{Hours}}{\text{Value}} : \frac{\$312\,800}{12\,000}$ — $ 26.07

7. Interest, insurance, taxes:

Annual rates : int. 10% ins. 2% of taxes – %
Estimated annual use 2 250 hours

$\frac{\text{Factor x del. price (item 1)}}{1\,000} = \frac{0\,34 \times \$391\,000}{1\,000}$ — $ 13.29

8. **Total hourly owning costs** — $ 39.36

Operating costs:

9. Fuel: Consumption x unit price
8.67 x $1.00 per gal — $ 8.67

10. Lubricants, filters, grease:

Engine	.06 x $10.50	per gal
Transmission	.03 x $10.50	per gal
Final drives	.02 x $10.50	per gal
Hydraulics	.03 x $ 7.50	per gal
Grease	.05 x $ 1.20	per lb
Filters	.85 x $ 0.56	

Lubricants, filters and grease sub-total — $ 1.96

11. Tyres: $\frac{\text{Replacement cost (item 2)}}{\text{Estimated life in hours}} : \$$ — $

12. Repairs: $\frac{\text{Factor x del. price less tyres (item 3)}}{12\,000}$

$\frac{0.9 \times \$391\,000}{12\,000}$ — $ 29.32

13. Special items: — $

14. **Total hourly operating costs** — $ 39.95

15. Operator's hourly wage — $ 2.50

16. **Total hourly owning and operating costs** — $ 81.81

ESTIMATED HOURLY OWNING AND OPERATING COSTS

Date:

Machine designation: Caterpillar D8K PS/Rome KG Blade

Depreciation value:

1. Delivered price (incl. attachments)		$357 000
2. Tyre replacement costs:		
Front		$
Drive		$
Rear		$ 71 400
3. Delivered price less tyre		$285 600
4. Less resale or trade-in value (optional) 20%		
5. Nett value for depreciation		

Owning costs:

6. Depreciation: $\frac{\text{Nett depreciation value (item 5)}}{\text{Depreciation period in hours}}$

$\frac{\text{Value}}{\text{Hours}} : \frac{\$285\,600}{12\,000}$ — $ 23.80

7. Interest, insurance, taxes:

Annual rates : int. 10% ins. 2% of taxes – %
Estimated annual use 2 250 hours

$\frac{\text{Factor x del. price (item 1)}}{1\,000} = \frac{0.34 \times \$357\,000}{1\,000}$ — $ 12.14

8. **Total hourly owning costs** — $ 35.94

Operating costs:

9. Fuel: Consumption x unit price
8.67 x $1.00 per gal — $ 8.67

10. Lubricants, filters, grease:

Engine	.06 x $10.50	per gal
Transmission	.03 x $10.50	per gal
Final drives	.02 x $10.50	per gal
Hydraulics	.03 x $ 7.50	per gal
Grease	.05 x $ 1.20	per lb
Filters	.85 x $ 0.56	

Lubricants, filters and grease sub-total — $ 1.96

11. Tyres: $\frac{\text{Estimated life in hours}}{\text{Replacement cost (item 2)}}$: $ — $

12. Repairs: $\frac{\text{Factor x del. price less tyres (item 3)}}{12\,000}$

$\frac{0.9 \times \$357\,000}{12\,000}$ — $ 26.78

13. Special items: — $

14. **Total hourly operating costs** — $ 37.41

15. Operator's hourly wage — $ 2.50

16. **Total hourly owning and operating costs** — $ 75.85

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UK taxation*

Property ownership by the non-resident

Part 2†

The tax repercussions of people letting their homes in the United Kingdom while working overseas require very careful consideration. *Part 1* of this article comprised an outline of the effect of property ownership in the UK on residence status. This, *Part 2,* examines those repercussions.

Unlike some other sources of income, there are no means of claiming exemption from UK tax on rental income received by non-residents. At the end of a financial year an account must be prepared, and if, after deduction of allowable expenses, a profit is shown, that sum will be liable to tax at the basic rate. In cases where the income is particularly large, higher tax rates could apply to the profits; indeed if the amount exceeds £1 700 there may also be some investment income surcharge to pay. In working out the assessable income, mortgage interest can be deducted from the net profit.

The method of tax collection depends entirely on whether the property is let through an agent or not. In both cases an account must be submitted to the Inland Revenue each April. If an agent is involved, collecting the rent, tax is usually payable in two instalments, a payment on account in January, and settlement of the balance after April when the final figures are agreed. If the tenant pays the rent direct to the owner or the owner's bank, the tenant is required to deduct tax at the basic rate, currently 33%, from the gross rent and pay this over to the Inland Revenue on the owner's behalf each week, month or quarter. The landlord must then wait until the end of the tax year to submit the claim for repayment in respect of the allowable expenses incurred and any mortgage interest paid.

Often an agent feels obliged to make some reserve for the tax liability, as, in law, he, and not the landlord, is responsible for paying the tax. However, if the agent accepts that the expenses will virtually cover the rent, it is normally possible to agree on a nominal figure of reserve. Estate Agents are obliged to report to their local tax offices, details of any rental income collected by them.

Moving on to the question of Capital Gains Tax, a person who is neither resident nor ordinarily resident in the United Kingdom is automatically exempt from this tax, but once he returns he becomes, chargeable to this levy. However, the UK resident is entitled to exemption on his main residence and, in certain circumstances, so are those who, due to living abroad, were unable to use the UK property as a normal home. It can be

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*Submitted for publication by Wilfred T. Fry Ltd., England.

†Part 1 was published in the May 1978 issue, pp. 285–286.

shown that before the property was first let and after the last tenant left, the house was owner occupied, and in the intervening period either the husband or wife was abroad engaged on full-time employment, there will be no capital gains tax payable on the eventual sale of the house even if the owner is regarded as resident in the United Kingdom during the year of sale – provided there have been no other properties qualifying for exemption during the period of ownership. There is no minimum period during which the house must be owner occupied before and after overseas residence. And it is not even necessary to re-occupy the house on returning if it can be shown that the requirements of new employment in the United Kingdom make it difficult for the owner to use the property again before sale.

In normal circumstances, then, the letting of a property while the owner works abroad should not preclude a claim for exemption from Capital Gains Tax.

This article has, of necessity, dealt with the normal situation. There are, to be sure, many variations which can complicate the tax position, for instance the ownership of more than one property and the provision of non-sterling loans to assist in house purchase. It is wise to tackle such problems in advance. Property owners concerned about their position will be well advised to obtain professional guidance before returning to the United Kingdom.

A glossary to help you understand management

Delegate – Pass the buck
Delegate upwards – Pass the buck back
Filed – Lost
Pending – What the hell do we do with this?
Delayed – Forgotten
Urgency – Panic
Extreme urgency – Blind Panic
Frank and open discussion – Flaming row
Analytical projection – Guess
Forecast – Guess
Long-range forecast – Wild Guess
Scheduled – Hoped for
Deficiency analysis – Pointing the finger
Ambitious – Ruthless
Strategy – Low cunning
Shrewd – Devious
Profit – Profit
Profit before tax – Loss
Deficit – Staggering loss
Industrial by-product – Out waste
Environment pollution – Other people's waste
Pilfering – Theft by employee
Fringe Benefit – Theft by Executive
Terminal Payment – Golden handshake
Supplementary statistical information – Padding
New – Last year's model in different colour
A radically different concept in space-age living – New
Adverse consumer reaction – The Boss's wife didn't like it
Ingeniously engineered – Incredibly difficult to install and service
Exhaustive tests – The Sales Manager took it home to his kids
Destructive tests – The Sales Manager's kids broke it

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The monthly crop

Standard Malaysian palm oil (SMPO). It is reported that the proposed Palm Oil Research Institute of Malaysia (PORIM) will give priority towards the introduction of a Standard Malaysian Palm Oil Scheme, similar to that of SMR Scheme for rubber. The Institute would also emphasise on research, aimed at improving the efficiency of extraction, further processing, achieving uniformly good quality, increasing the existing uses and developing new ones. A Bill is being drawn up to provide for the establishment of the Institute as well as the Malaysian Palm Oil Research and Development Board.

Cess for seeds. From January 1, 1979 the Sabah Government will impose a 10 per cent cess on cocoa, when its price exceeds $4 000 per ton. This is to raise funds for its cocoa seed expansion programme and to assist smallholders.

PORAM's memorandum on the budget. The Palm Oil Refiners Association of Malaysia has submitted a memorandum on the new Budget to the Minister of Finance. In it

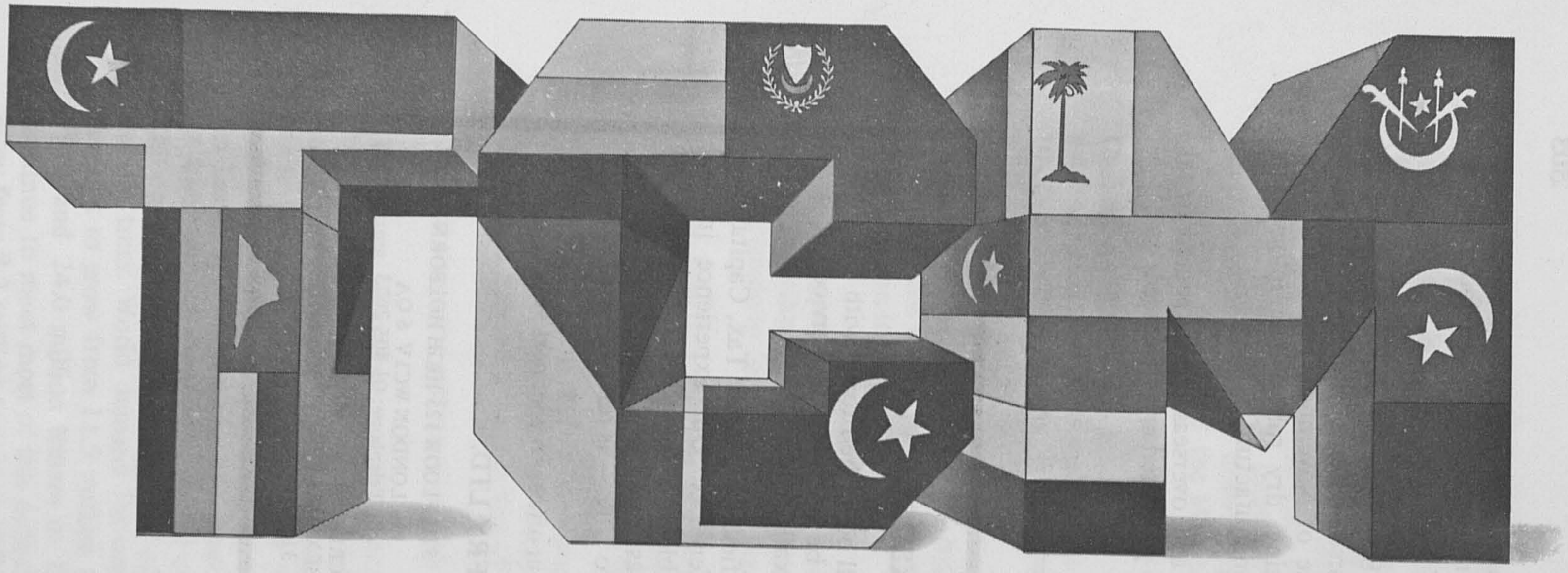
- it suggested that a fixed duty system be evolved to overcome the prevailing uncertainty about export duty, and that such system remain in force for five years
- it re-affirms its support to the compulsory registration of forward contracts of both crude and processed palm oil and proposed that the computation of export duty be based on the traded prices
- it asks for tax exemption on its contribution to the Palm Oil Research Institute of Malaysia (PORIM) and Palm Oil Registration and Licensing Authorities (PORLA), and
- it urges the setting up of Palm Oil Commodity Exchange.

The future of rubber. A joint study by the World Bank and FAO reveals that by 1990 there would be a demand gap for natural rubber of around half a million tonnes. The study urges that plans for increased production be made immediately in view of the long gestation period. Such plans could include replanting and revitalising of low yielding plantations in Indonesia, Sri Lanka and Nigeria and the rehabilitation of the natural rubber industries of Vietnam and Cambodia. It also suggested increased planting in India, the Philippines, West Africa and Brazil and the greater use of chemical stimulants on old trees. World demand for natural rubber and synthetic substitutes is forecast to grow from 11.5 million tonnes in 1976 to 14.5 million tonnes in 1980 and 24.0 million tonnes in 1990. Though synthetic substitutes will continue to meet most of this demand, natural rubber output is projected to grow from 3.2 million tonnes in 1976 to 6.1 million tonnes in 1990.

Seminar on natural rubber technology. A two day seminar on natural rubber technology to examine new developments in rubber based industries will be held in Kuala Lumpur from November 30.

This seminar, organised by the Rubber Research Institute of Malaysia will be a follow up to the one week course on natural rubber in engineering to be held in Kuala Lumpur in middle of November, and will focus on development in natural rubber processing, dry rubber technology, latex technology and application and product manufacture.

About 250 participants, both local and overseas, are expected to take part and about 20 working papers will be presented and discussed.



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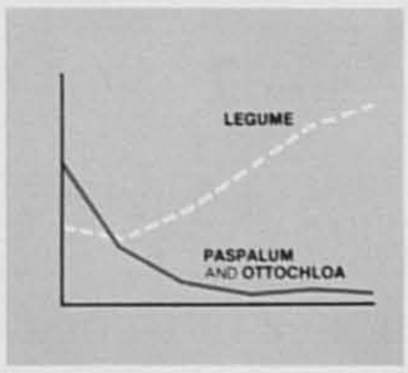

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Estate Book-keeping Examination

May 24, 1978

(Examiner's comments on answers)

9.00 a.m. *Time : 2 hours*

The maximum marks for each question are shown in brackets

Candidates are required:

(a) To answer all questions
(b) To start each question on a fresh sheet
(c) To arrange answers in the numerical order of the questions.

Question 1 (20 marks)

(1) Define the following terms:-

Accrual
Prepayment

(2) An estate has its financial year ending 31st December. A Planting Advisor makes an agricultural inspection of the estate twice a year for a fee of $3 600 per annum. A visit was made in March and payment of the annual fee was made in April. Draw up the 'Planting Advisor's Fees' account for the period January to June showing the balances carried forward and brought forward at the end of each month. Indicate whether each balance is a prepayment or an accrual and what the monthly charge to the Profit & Loss Account should be.

(1) An accrual is defined as the charge incurred for a benefit for which payment is made in a later period. A prepayment is defined as the payment for a benefit in a period before the benefit is received.

(2) The monthly charge to the Profit & Loss Account is ($3 600 ÷ 12) $300. The account should appear as follows:

PLANTING ADVISOR'S FEES

Jan.	*Accrual*	*C/F*	*300*	*Jan.*	*P. & L. A/c.*		*300*
Feb.	*Accrual*	*C/F*	*600*	*Feb.*	*Accrual*	*B/F*	*300*
					P. & L. A/c.		*300*
Mar.	*Accrual*	*C/F*	*900*	*Mar.*	*Accrual*	*B/F*	*600*
					P. & L. A/c.		*300*

Apr.	*Payment*		*3 600*	*Apr.*	*Accrual*	*B/F*	*900*
					P. & L. A/c.		*300*
					Prepayment	*C/F*	*2 400*
May	*Prepayment*	*B/F*	*2 400*	*May*	*P. & L. A/c.*		*300*
					Prepayment	*C/F*	*2 100*
June	*Prepayment*	*B/F*	*2 100*	*June*	*P. & L. A/c.*		*300*
					Prepayment	*C/F*	*1 800*

Question 2 (15 marks)

The bank manager telephones the estate and advises you that he intends to dishonour the estate's cheque to the weeding contractor for $5 000 since the estate's bank account would become overdrawn. The chief clerk, however, shows you the cash book which indicates a balance at bank of $6 740.20. You decide to investigate and discover the following:-

(1) A cheque to XYZ Sdn. Bhd. for $3 460.10 has been entered in the cash book but has still to be signed by you.

(2) An incorrect credit entry in the cash book of $10 630.80 in respect of wages has been made and needs to be reversed.

(3) A cheque to the ABC Co. for $7 320.30 although entered in the cash book and signed by you has still to be sent out in the mail.

(4) The estate Land-rover was sold for $6 750 but the buyer's cheque had not been paid into the bank.

You are required to determine what the bank balance was *before* the issue of the cheque to the weeding contractor. Marks will be awarded for a neat and sensible format.

To determine the bank balance, the proper approach is to take the cash book balance of $6 740.20 and adjust it by the items shown in the question.

Question 3 (25 marks)

You are required to enter the following transactions in a cash book containing both 'Bank' and 'Petty Cash' columns:–

May 1st Balance brought forward from the previous month for Petty Cash in hand of $150 and cash at bank of $3 660.40.

3rd $50 cash paid to the manager and his cheque for that amount was banked on the same day.

4th H.Q. remittance of $6 000 was credited to the bank account.

5th A cheque for $2 000 was sent to the manure suppliers.

6th The Senior Assistant was paid $95 in cash in respect of his travelling expenses.

10th A cheque for $51.20 in payment of the telephone bill was despatched.

14th Cash of $7 000 was drawn from the bank and paid out as follows:-

Advances	$6 900
Petty Cash	100

20th Cash for postage of $30 was paid out.

25th Cash for the sale of rubber logs was received – $600

31st The petty cash is kept on an 'imprest' of $150 and any deficit/surplus is adjusted to the bank on the last day of every month. This was done.

31st The cash book is ruled off and the balances carried forward.

The transactions presenting the greatest difficulty were:-

(1) May 14th. $6 900 was drawn from the bank and paid out in advances so all that was necessary was to make a credit entry in the bank column.

$100 was drawn as petty cash so the entries are to credit the bank and debit the petty cash columns.

(2) May 31st. As the petty cash is kept on an imprest of $150 this must be the debit balance carried down in the petty cash column. The difference required to arrive at this figure ($525) had to be credited in the petty cash columns and debited in the bank column i.e. the surplus petty cash was banked.

Question 4 (10 marks)

(1) What do you understand by a 'Suspense' account and in what circumstances should it be used?

(2) Cash was drawn for total wages of $25 000 on the 28th of the month but it was not until the 1st of the following month that the exact 'distribution' was compiled as follows:-

Tapping	$17 000
Weeding	3 000
Factory	2 000
Overtime	2 000
Miscellaneous	1 000

Complete a 'Suspense' account in respect of the above transactions.

A suspense account is opened to house those transactions sufficient details of which are not known thus preventing them from being posted to their proper places in the accounts. The purpose of housing them in a suspense account temporarily is to enable the double entry to be made so that the books are always in balance.

Question 5 (30 marks)

(1) What is the difference between a 'Stores Account' card and a 'Bin' card? Draw up typical examples for each.

(2) On your formats enter the following transactions for material x.

May	1st	Balances brought forward –	Qty. (units)	120
			value	$360
	3rd	Issued to Workshop 90 units		
	7th	Delivered to stores 60 units at $6 per unit		
	10th	30 units destroyed by fire		
	17th	Units destroyed by fire replaced at $3 per unit.		

Note the following:-

(a) The balance in quantity and value should be shown after each transaction.

(b) The unit price is calculated at the 'todate average' method and should also be shown after each transaction.

The essential difference between a 'Stores Account' card and a 'bin' card is that the former records, inter alia, both quantity and value for each stores item while the latter, being for the storekeeper's benefit, records quantity only as values are irrelevant for his purpose.

General

Questions are based on Judson's 'A Guide to Estate Accounts' and candidates sitting for this examination must use it as a standard text book.

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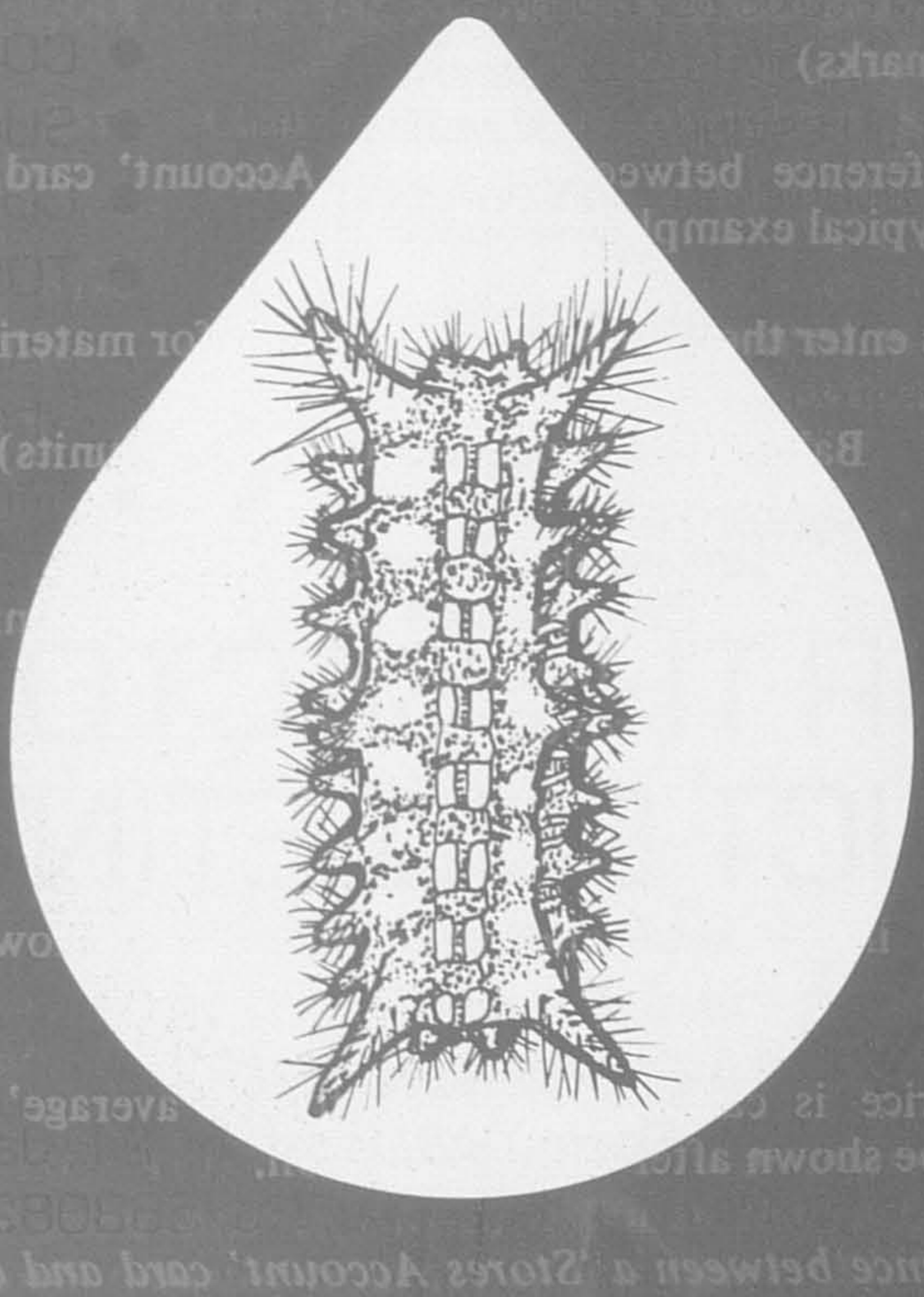

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Hor Tuck Fook	(Selangor)	Passed
Lim Cheng Loke	(S. Johore/S'pore/Rhio)	Passed
Chin Hon Tin	(Sabah-Tawau)	Passed

Agricultural Science (Soils)
May 10, 1978

Chin Hon Tin	(Sabah-Tawau)	Passed
Fung Sui Kiong	(Sabah-Tawau)	Passed
Mok Ing Hua	(Sarawak)	Passed
Abd Latip b Hj Mohd Zain	(Central Johore)	Passed

Estate Book-keeping
May 24, 1978

K.E. Sam	(S Johore/S'pore/Rhio)	Passed with Distinction
Hassan bin Hussein	(Central Perak)	Passed
Khoo Foo Chai	(Malacca/Muar)	Passed
Abu Hassan b Isa	(North West Malaysia)	Passed
J. Anwar Shahbuddin	(North West Malaysia)	Passed
Fuad Ahmad	(North West Malaysia)	Passed
R. Vettiveloo	(North West Malaysia)	Passed
Gan Lian Tiong	(Selangor)	Passed with Distinction
Tee Thiam Keng	(Selangor)	Passed with Distinction
K.M. Shanmugam	(Selangor)	Passed
Bidin b Hussin	(Selangor)	Passed
Abdullah b Hj Ahmad	(Selangor)	Passed
Abd Aziz b Hasan Raza	(Selangor)	Passed
Katar b Jamin	(Selangor)	Passed

Chua Keng Lim	(Selangor)	Passed
Cheah Fook Wan	(Selangor)	Passed
Mohd Khairi b Hj Abdul Aziz	(Selangor)	Passed
Sim Hock Soon	(Lower Perak)	Passed
A. A. L. de Jong	(Lower Perak)	Passed
Lee Foo Wah	(Lower Perak)	Passed
B. Sasheendran	(Lower Perak)	Passed
Tiong Ming Du	(Lower Perak)	Passed
Yoong Ching Pin	(Lower Perak)	Passed
M. Nagarajah	(Central Johore)	Passed with Distinction
Ng Chang Huat	(Central Johore)	Passed
Shahabuddin b Mohd Kamil	(Central Johore)	Passed
Baharin b Ismail	(Negri Sembilan)	Passed with Distinction
Zhazali b Md Yunus	(Negri Sembilan)	Passed
Tan Tong Sin	(Negri Sembilan)	Passed
P. Gopalasamy	(North Johore)	Passed
Low Heng Jin	(North Johore)	Passed
Tay Chuan Chan	(North Johore)	Passed
Azali b Md Zain	(West Pahang)	Passed
Looi Heng Chooi	(West Pahang)	Passed
Ramli b Othman	(Kelantan)	Passed with Distinction
Boo Pee Puat	(Kelantan)	Passed with Distinction
Ng Kon Sung	(Sabah-Tawau)	Passed with Distinction
Abdullah Minun b Hj Sahirun	(Sabah-Tawau)	Passed
Chin Hon Tin	(Sabah-Tawau)	Passed
Raymond Tan Beng Chan	(Sarawak)	Passed with Distinction
Denis Chang Soo Kiong	(Sarawak)	Passed with Distinction
Pang Seng Nam	(Sarawak)	Passed
Pascal Kabuin	(Overseas)	Passed

New members

6954 Morais, John, Sungei Mai Estate, Jerantut, Pahang.

6955 Anuar bin Ismail, Kuala Reman Estate, Kuantan, Pahang.

6956 Ashari bin Mohd Don, Sg. Biong Division, Kuala Kangsar Estate, Sauk, Kuala Kangsar, Perak.

6957 Chai Min Fah, Bagan Datoh Estate, Bagan Datoh, Perak.

6958 Salim bin Gilan, Pamol (S) Ltd, P O Box 203, Sandakan, Sabah.

6959 Mohamad Hashim bin Ahmad Tajudin, H & C Oil Palm Research Station, P O Box 207, Banting, Selangor.

6960 Goh An Te, Lambak Elaeis Estate, Kluang, Johore.

6961 Kamarudin bin Mohd Zin, Sungai Jabor Estate, c/o Jabor Valley Estate, Kuantan, Pahang.

6962 Yap Mun Yew, Selborne Estate, Padang Tengku, Kuala Lipis, Pahang.

6963 Ismail bin Abd Latif, Sengkang Estate, Port Dickson, Negri Sembilan.

6964 Hutabarat, M J, PTP II, Tanjong Morawa, Medan, Indonesia.

6965 Otong, H (Ir), Jalan Imambonjol No 21, Medan, Indonesia.

6966 Wilson, B G, Bialla Plantation, c/o P O Box 1127, Rabaul, Papua New Guinea.

6967 Borne, R V, P O Box 32, La Ceiba, Honduras, Central America.

6968 Ahmad Djamhuri Malimungang, 19 Jl D I Panjaitan, Tebing Tinggi, Deli, North Sumatra, Indonesia.

6969 Mukete, V E, Cameroon Development Corporation, Bota, Victoria, Cameroon.

6970 Akpan, C O, Cross River Estates Ltd, PMB 1080, Calabar, Nigeria, West Africa.

6971 Mah King Seng, No 8 Jalan Raja, Teluk Anson, Perak.

6972 Ravindran @ Ravikumar s/o R Bhaskaran Nair, Labu Estate, Labu, Negri Sembilan.

6973 Abdullah bin Syed Mustaffa (Syed), Sungei Samak Estate, Ulu Bernam, Perak.

6974 Zainal bin Ahmad, Anak Kulim Estate, Kulim, Kedah.

6975 Rusli bin Ujang, Riverside Estate, Kuala Selangor.

6976 Shanmugam, A (Dr), 146 Lorong Tiga, Taman ABCE, Bahau, Negri Sembilan.

6977 Mohd Rusli Mohd Yusof, RRIM Bukit Ibam, Pekan, Pahang.

6978 Chong Ah Fatt, Edwin, Ulu Bernam Estate, Division II, Ulu Bernam Post, Lower Perak.

6979 Phua Cheng Sye, 55/57 Jalan Besar, Kuantan, Pahang.

6980 Gabriel, V, Sua Betong Estate, Port Dickson, Negri Sembilan.

6981 Eboka, A I, Sua Betong Estate, Port Dickson, Negri Sembilan.

6982 Nunga, C P, Sua Betong Estate, Port Dickson, Negri Sembilan.

6983 Nkumbe, I C, Sua Betong Estate, Port Dickson, Negri Sembilan.

6984 Munikrishnayya s/o C K S Naidu, Lothian Estate, Nilai, Negri Sembilan.

6985 Chin Fook Min, Semporna Estate Sdn Bhd, P O Box 12, Semporna, Sabah.

6986 Fadzil Othman Merican bin Idris, Jalan Acob Estate, Kapar, Selangor.

6987 Radaha Krishnan s/o Kalimuthu, Hoechst (M) Sdn Bhd, P O Box 540, Kuala Lumpur.

6988 Acosta, A, Palmas de Tumaco Ltd, C 26 # 13–19 P 32, Bogota. Colombia, South America.

6989 Manickavasagam, J, 16 Pesiaran Seputeh, Kuala Lumpur.

6990 Chung Hon Kiong, Sabapalm Estate, P O Box 61, Sandakan, Sabah.

6991 Cheng Mui Fah, Andrew, Sabapalm Estate, P O Box 61, Sandakan, Sabah.

6992 Ukoh, E A, Sabapalm Estate, P O Box 61, Sandakan, Sabah.

6993 Abu Bakar bin Baharom, Ladang Getah Kampong Sekijang, P O Box 515, Segamat, Johore.

6994 Sellamuthu, R, North Hummock Estate, Kelang, Selangor.

6995 Chin Thiam Hock, Peter, HFR Plantations Sdn Bhd, P O Box 688, Tawau, Sabah.

6996 Low Choon, Dominic, HFR Plantations Sdn Bhd, P O Box 688, Tawau, Sabah.

6997 Seah, C Y, Benjamin 211 Lavender Street, Singapore 12.

6998 Foong Lai Choong, Damansara Estate, Batu Tiga, Selangor.

6999 Kwan Pek Sin (Miss), SASCO Sdn Bhd, Locked Bag Service No 9, Tawau, Sabah.

7000 Yam Sin Fah, Kuantan Trading Co Sdn Bhd, P O Box 11, Segamat, Johore.

7001 Hopper, Patricia W. (Mrs), Kilinwata Plantations, P O Box 384, Rabaul, Papua New Guinea.

7002 Wilson, A A J, Skinner C C A, Box 109, Santo Domingo de Los Colorados, Ecuador, S. America.

7003 Quah Chien Khong, Rubana Estate, Teluk Anson, Perak.

7004 Abdul Halim bin Abdul Majid, Rubana Estate, Teluk Anson, Perak.

7005 Cassels, P K, North Borneo Timbers Bhd, P O Box 137, Tawau, Sabah.

7006 Cooper, J L (Jr) Liberian Rubber Development Unit, P O Box 3554, Monrovia, Liberia.

7007 Raja a/l Karupiah, Eldred Estate, P O Box 102, Bekok, Johore.

7008 Sarathy, S P, Ulu Bernam Estate, Ulu Bernam, Perak.

7009 Ismail bin Hussein, Monsanto (M) Sdn Bhd, 116 Jalan Semangat, Petaling Jaya, Selangor.

7010 Wong Cheng Hin, Ladang Sungei Rinching, Semenyih, Selangor.

Rejoined

4859 Jayatilaka, J L R, AISP, Sungei Mai Estate, Jerantut, Pahang.

5958 Abdul Kudus Abdul Rahman @ Kudus Jafri, Korporasi Pembangunan Desa, P O Box 1501, Kota Kinabalu, Sabah.

4144 Walker, W S, Air Puteh Estate, P O Box 19, Kemaman, Trengganu.

5731 Lim Heng Kit Paul, Hap Seng Plantation Sdn Bhd, P O Box 666, Tawau, Sabah.

6215 Rahman bin Lambak, Behn, Meyer & Co (M) Sdn Bhd, No. 236–B Jalan Tun Abd Razak, Johore Bahru.

Life members

3469 Eakin, T R D, 14 Clappentail Park, Lyme Regis, Dorset, U K.

4015 Cook, C L, MA AISP, c/o Lloyd's Bank Ltd, Carfax, Oxford, U K.

Reverted to active membership

5843 Jamaluddin Arshad, Kumpulan Suria Bhd, 2nd Floor, Sharidal Complex, Jalan Yong Shook Lin, Petaling Jaya, Selangor.

Suspense list

6077 Lim Chin Hock

Change of address

5059 Abdul Alim bin Abdul Satar, Mengkuang Plantation Sdn Bhd, c/o Pejabat Pos Triang, Pahang.

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6297 Aritonang, Radja, SLDB, Sungai Kawa Scheme, P O Box 359, Tawau, Sabah.

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6222 Abdullah bin Busu Hanifah, Ladang Ketengah Perwira, d/a Jabor Valley Estate, Kuantan, Pahang.

6208 Abdul Kadir bin Karim, K P M Niaga, P O Box 2403, 11th Floor, Fitzpatrick Building, Jalan Raja Chulan, Kuala Lumpur.

6323 Abdul Mukti bin Abdul Rahman, Sungei Wangi Estate, Sitiawan, Perak.

5832 Chandapillai, M M, Lembaga Kemajuan Ternakan Negara, Jalan Selangor, Petaling Jaya, Selangor.

4347 D'Cruz, C M, Selama Estate Group, Serdang, Kedah.

5723 Fua Jee Mok, ICI Australia Limited, Merrindale Research Station, P O Box 141, Croydon, Victoria 3136, Australia.

6120 Ho, James Philip, Kuala Ketil Estate, Kuala Ketil, Kedah.

5583 Hubbard, F T P, PJK, 25 Lorong Thomson, Ipoh, Perak.

6611 Hutagalung, R I (Dr), No 14, Jalan 20/6, Petaling Jaya, Selangor.

5005 Joseph, C I, 49 Jalan Camp, Sungei Patani, Kedah.

6961 Kamarudin bin Mohd Zin, Sungai Jabor Estate, c/o Jabor Valley Estate, Kuantan, Pahang.

5992 Katar bin Jamin, Prang Besar Estate, Kajang, Selangor.

6151 Lim Cheng Loke, Kelan Estate, Kulai, Johore.

6549 Lee Yew Foong, Nova Scotia Palm Oil Factory, Teluk Anson, Perak.

5017 Leong Heng Khoon, Pelam Estate, Kulim, Kedah.

6358 Lam Hee, Asian Institute of Management, Makati, Metro – Manila, Philippines.

5261 Murthy, P M Sathyah, Senawang Estate, Sungei Gadut, Negri Sembilan.

4294 Mak Kim Hong, Tanah Merah Estate, Tangkak, Johore.

3491 Macpherson, D A, AMBIM AISP, Regent Estate, Batang Melaka, Negeri Sembilan.

6342 Mok Chik Wah, Frankie, Sabah Planting Enterprise, P O Box 109, Tawau, Sabah.

6057 Musa bin Salami, Sungei Sedu Estate, Banting, Selangor.

6809 Rubio, Diego C (Dr), Ph. D., Granja Marathon – Goodyear, Paracrevea Borracha Vegetal S A, Caixa Postal 445, Belem, Para, Brasil.

6975 Rusli bin Ujang, Riverside Estate, Kuala Selangor.

6610 Rajoo s/o D Moothy, 1323, Lorong 7, Kg Besut, Kemaman, Trengganu.

6409 Rajan Guna, M, Felda Merchong 01, c/o Felda Wilayah Pahang Selatan, Bukit Ibam, Pekan, Pahang.

6856 Radha Krishnan s/o A S Nair, Minyak Division, Sungei Tinggi Estate, Batang Berjuntai, Selangor.

5304 Stewart, M D, Bute Estate, Nilai, Negri Sembilan.

6240 Toh Choo Wooi, Norseman Estate, Ulu Sepetang, Taiping, Perak.

6883 Vendargon, V P, Belata River Estate, Kerling, Selangor.

6687 Wong Tin Sang, Lum Trading Co Sdn Bhd, c/o Sin Lian Heng & Co, No 28 Jalan Awang, Segamat, Johore.

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