AA RESEARCH NEWS

January '93

EDITORIAL

The planting industry has come a long way since its early days when planters had to contend with difficult working conditions and poor communication. Today's planters are generally much luckier in these respects. However, they have to operate in a more competitive environment with rising cost of inputs and unstable and often low commodity prices. They also have to farm in a more environmentally friendly manner.

Efficient and proper utilization of by-products which were often burnt or discarded in the old days is now an integral part of plantation management.

We have devoted this issue of our Newsletter to the utilization of four important by-products from our plantations, namely rubberwood, empty fruit bunches (EFB), palm oil mill effluent (POME) and cocoa pod husks.

Mr. Loh very ably highlighted the current trend in rubberwood utilization with his interesting article entitled Seeing gold in old rubber trees in the June '93 issue of The Planter.

The growing demand for rubberwood augers well for the rubber planters. Hopefully, the additional revenues from rubberwood would eventually increase to a level that will be attractive enough for the rubber planters to continue planting the crop even when the price of rubber is marginally profitable.

While there is a ready market for rubberwood, EFB, POME and cocoa pod husks are not readily marketable. They could, however, be gainfully utilized as organic fertilizers and soil ameliorations.

EFB is particularly useful for mulching palms planted on sandy and poor soils. It is also highly beneficial to mulch young cocoa and oil palms with EFB.

Treatment and disposal of POME as a waste product is an expensive operation. The same by-product if properly applied to the palms has been shown to improve soil properties and increase the yield besides reducing the cost of manuring.

For cocoa, adoption of good harvesting practices such as harvest and split the pods on plant by plant basis is an efficient way of recycling plant nutrients thereby reducing the requirements for fertilizer inputs. At the same, workers' productivity also improves with less load to carry.

Ooi, L. H.

CONTENTS

RECYCLING OF COCOA POD HUSKS

1. Introduction

Cocoa pod husks are a good source of nutrients and if properly recycled to the plants could result in considerable saving in the cost of manuring besides providing breeding sites for the cocoa pollinating insects particularly the Ceratopogonid midges.

2. Nutrient content

Thong and Ng (1978) reported that the pod husk fraction contains about 34% N, 27% P, 80% K, 78% Ca, 48% Mg, 71% Mn and 47% Zn removed in the cocoa pods.

The amount of nutrients in the cocoa pods for dry bean yield of 1 t/ha/yr is summarized in Table 1 overleaf.

Table 1:Amount of nutrients in the cocoa pods for dry bean yield of 1 t/ha/yr

Nutrients	Amount of Nutrients (kg/ha)		
	Bean fraction	Husk fraction	Total
N	20.4 (66)	10.6 (34)	31.0
P	3.6 (73)	1.3 (27)	4.9
K	10.5 (20)	43.3 (80)	53.8
Ca	1.1 (22)	3.8 (78)	4.9
Mg	2.7 (52)	2.5 (48)	5.2
Mn	0.032 (29)	0.080 (71)	0.11
Zn	0.048 (53)	0.045 (47)	0.09

Source : Thong & Ng (1978)
Note : Figures in brackets indicate % of total

3. Effects on soil and leaf nutrient content

Ling (1983) reported that pod husks improved the soil chemical properties and also raised the K status of cocoa leaf (Table 2) on an inland soil in Pen. Malaysia.

Table 2 : Effects of pod husk on soil chemical properties at 0-15 cm depth and leaf K

Parameter	Without pod husk	Pod husk at 10 kg dm/plant
pH	4.4	4.4
Total N (%)	0.139	0.138
Available P (ppm)	58	63
Organic C (%)	1.13	1.35*
Acid extractable K (meq/100 g)	1.69	2.13*
Acid extractable Mg (meq/100 g)	0.95	0.99
Acid extractable Ca (meq/100 g)	1.16	1.21
Leaf 4 K (% dm)	1.89	2.05**

* Significant at 5%
** Significant at 1%
Source : Ling (1983)

Key
dm = dry matter

It is obvious from the above results that cocoa pod husks are an effective source of plant nutrient.

4. Recommendations

Harvest and split pods on plant by plant basis

The ideal way to recycle the pod husks is to harvest and split the pods on plant by plant basis and scatter the pod husks around the base of the plant from which the pods were harvested. In this way, the amount of pod husks returned will be proportional to the amount of the pods harvested for each plant. This method will also reduce the load of the harvester thereby improving the harvester's output.

5. Conclusions

Efficient recycling of pod husks should significantly reduce nutrient inputs required in cocoa areas. A review of the current harvesting and pod husk disposal methods to check if there is further room for improvement and recycling of pod husks will probably be very beneficial. Any technique to improve the efficiency of harvesting and pod husk disposal with minimal P&D problems will no doubt be very welcome by the cocoa industry, particularly at this time of very low cocoa prices.

References

1. Thong K.C. and Ng W.L. (1978). Growth and nutrients composition of monocrop cocoa plants in inland Ma laysian soils. Proc. Int. Conf. On Cocoa and Coconuts K.L. : 262-286.

2. Ling A.H. (1983). Cocoa nutrition and manuring on inland soils in Pen. Malaysia. Proc. 2nd National Co coa Conf. Medan. : 119-135

Splitting cocoa pods in heaps
- not recommended

UTILIZATION OF EFB AND POME

Introduction

The benefits of mulching with oil palm empty fruit bunches (EFB) and land application of palm oil mill effluent (POME) are now well-known. Proper utilization of these by-products not only solves the disposal problems, it also reduces the cost of fertilizer inputs and at the same time improves yields.

A) Empty fruit bunches (EFB)

Analysis of EFB from Tuan Mee Mill showed the following nutrient content.

Nutrients on % dry matter basis

%M.C.	N	P	K
64	0.77	0.10	2.78

Approximate rate of application suggested is 40 tons wet 14.4 tons dry EFB per hectare, say 56 bunches of 5.kg wet weight (1.9 kg dry weight) per palm which on nutrient and fertiliser equivalent basis is

Nutrients (kg/ha)

N	P	K
111	14	400

Fertiliser equivalent kg/palm (138 p/ha)

AC	CIRP	M.Potash
3.2	0.8	5.8

Mulching with EFB therefore supplies the palms with large amounts of nutrients. Fertilizer inputs may thus be reduced accordingly.

To facilitate adjustment in fertilizer rates, the following two points need to be observed :-

1) Mulch systematically on per manuring block basis and
2) Inform the agronomist-in-charge as soon as mulching has been completed for each block.

Mulching with EFB

B) Palm oil mill effluent (POME)

POME is a good source of nutrients (Table 1)

Table 1 : Equivalent fertiliser value of POME

Nutrient content in slurry (ppm)(1)		Kg Nutrient per t effluent(2)	Kg Fertiliser equivalent kg/palm
N	2500	2.5	11.9 AS
P	800	0.8	5.08 CIRP
K	2000	2.0	3.33 MOP
Mg	1000	1.0	4.70 KS

(1) Average compsosition
(2) Specific gravity of effluent = 1
Source: HRU technical paper No. 3/85/KKK/at

Field application of POME

POME has also been shown to improve oil palm yields (Table 2)

Table 2 : Effect of palm oil mill effluent application on oil palm yields

Method of application and type of effluent	Soil type	Rate of application	Tonnes ffb/ha
Tractor-trailer system Raw POME (i)	Rengam	Control	70.02 (100%)
		540 1/p/yr = 0.75 cm rey	77.30 (110%)
		740 1/p/yr = 1.00 cm rey	74.49 (106%)
		1240 1/p/yr= 1.70 cm rey	73.35 (105%)
Sprinkler system (ii) supernatant + slurry	Durian	Control	87.01 (100%)
		9 cm rey	97.91 (113%)
		18 cm rey	103.33 (119%)
		36 cm rey	101.25 (116%)
Flatbed system (iii) supernatant	Serdang	Control	57.74 (100%)
		5 cm rey	63.32 (110%)
		10 cm rey	69.11 (120%)
		20 cm rey	57.55 (99%)
Furrows & channels supernatang (iv)	Durian	Control	35.14 (100%)
		30 cm rey	43.62 (124%)
	Malacca	Control	40.01 (100%)
		30 cm rey	46.62 (117%)
Flatbed slurry (ii) + supernatant	Selangor	Control	44.3 (100%)
		1.25 cm rey	47.8 (108%)
		2.50 cm rey	49.3 (110%)
		5.00 cm rey	46.9 (106%)

i) Yeoh K. H. (1983)
ii) Lim c. H. et al. (1983)
iii) Lim K. H. et al. (1983)
iv) Tan K. S. et al. (1983)
rey = rain equivalent per year
Figures in brackets are percentage of control
Source: HRU technical paper No. 3/85/KKK/at

Recommendations

Excessive application can reduce yields. Apply no more than 480 l/palm/year (Tractor-trailer system). At this rate, there is no need to apply any mineral fertilizers at all. As for EFB, application of POME should be carried out on per manuring block basis and inform AAR of the progress as soon as possible.

Environmental Quality Act, 1974

Land application of POME is subjected to the above mentioned Act. Estates must therefore comply with the conditions specified in the Act. Among the important points to take note are :-

1) Permission is required from the Ministry of Science, Technology and Environment.
2) Biological oxygen demand (B.O.D.) load of the POME must be below 5000 ppm
3) A levy of $50/100 t of POME applied must be paid.

Conclusions

EFB and POME far from being agricultural wastes are valuable resources as inorganic fertiliser substitutes. When properly applied, they have been shown to improve soil properties and increase crop yield. At the same time they save manuring cost.

Ooi,L.H.

RUBBERWOOD UTILIZATION

Introduction

An International Forum on Investment Opportunities in Rubberwood Industry was held in K.L. from September 20-22, 1993. This was jointly organised by the International Trade Centre UNTAD/GATT (ITC) and Asean Timber Technology Centre (ATTC).

The forum underscored the growing importance and demand for rubberwood. This paper attempts to summarise the highlights of the forum and to relate their implications to the management of rubber plantations. The subject matters covered were as follows:-

1. Facts and figures on growing demand
2. Current utilization of rubberwood.
3. Strength and weakness of rubberwood and comparative prices against other woods.
4. Yield of rubberwood in terms of
   - potential yield
   - sawn log of >20 cm diameter
   - sawn timber.
5. Estimated cost of production and profit.
6. Implications.

1. Demand of rubberwood

a) Research and Development and Promotion of rubberwood.

Industrial utilization of rubberwood is rather recent. Realising the importance and potential of this valuable resource, the Ministry of Primary Industries initiated a Rubberwood Research and Utilization Committee in 1978 to spearhead and co-ordinate R & D to facilitate and promote utilization of rubberwood. The Committee has organised two National Rubberwood Seminars in 1982 and 1985 and an International Rubberwood Seminar in 1990.

Besides producing various publications on processing and utilization of Rubberwood, there were regular Rubberwood Processing Courses jointly organised by Malaysia Timber Industry Board (MTIB), Forest Research Institute of Malaysia (FRIM), University Pertanian Malaysia (UPM) and ATTC. These efforts were found to be effective in helping to transfer the appropriate technology in processing and utilizing Rubberwood to local wood-processing and exporting companies.

This technology transfer was further complemented by intensive promotion and marketing activities for rubberwood products by MTIB, ATTC, other government agencies and individual companies.

b) Production and Export of rubberwood

Production of rubberwood logs in Pen. Malaysia has been increasing steadily, reaching a figure of about 1,837,000 cu. metres in 1992 against about 898,000 cu. metres in 1987, an increase of 104 % over the 6-year period.

The largest use of sawn log is the production of sawn timber, at conversion rate of around 25% to 35% depending on log condition such as size, physical damages and effectiveness of pesticide treatment. In the past, substantial amount of sawn rubberwood was exported. Since 1990, a levy of RM 120 per cu. metre was imposed. This was meant to activate diversification into more value-added manufacture within the country, thus resulting in decline of sawn timber export from then on. In 1992, the sawmilling sector which consists of 172 rubberwood sawmillers utilized about 1.08 million cu. metres of sawn logs.

c) Price of sawn rubberwood

The increasing demand of sawn rubberwood is best indicated by the price of the timber exported. The price of sawn rubberwood has increased from RM 310 per cu. metre in 1985 to RM 630 per cu. metre in 1993.

Sawn rubberwood logs

2. Current Utilization of Rubberwood

a) Furniture and furniture components

The major use of sawn rubberwood is for the production of furniture and furniture components. In 1992 it was estimated that there were about 87 furniture mills involved in manufacturing rubberwood furniture in Malaysia. The value of rubberwood furniture exported from Malaysia in 1992 was estimated to be about RM 405 million, out of a total of approximately RM580 million of furtniture export (i.e. 70%), indicating the commercial importance of rubberwood in the furniture industry.

The greatest attribute of rubberwood in furniture manufacturing lies in its uniform texture and colour which could be stained and finished to meet various market requirements. In addition, it has excellent machining properties eg. sawing, planing, shaping and sanding.

Rubberwood furniture components

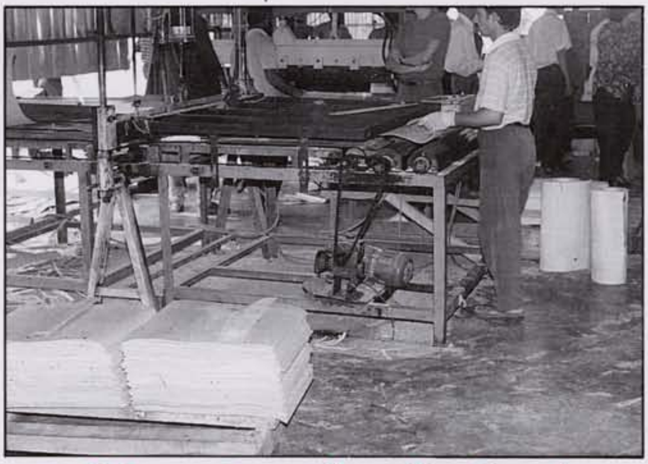
b) Joinery and Moulding.

Joinery and moulding item currently produced using rubberwood include solid doors, parquet flooring, laminated timber and staircase components.

Rubberwood parquet can be easily produced from sawmill waste and off-cuts from furniture manufacturing plants.

c) Panel products

The large volume of smaller diameter logs and branches available during the harvesting of rubber logs has attracted the establishment of industries to manufacture panel products. Presently the panel products manufactured are chipboard, particleboard, wood cement board, and medium density fibreboard. More recently rubberwood has been used to produce veneer for plywood.



Rubberwood veneer for making plywood

3. Strengths and Weakness of Rubberwood

a) Strengths

Rubberwood has numerous beneficial properties for the manufacture of quality value-added products:-

- Light colour - its attractive and pale cream colour is uniform with no differentiation between sapwood and heartwood.
- Good machinability - with proper technique and tooling it is easy to saw and machine into compo nent parts. In addition it can be carved and em bossed.
- Stainability - Stains and lacquers can be applied to produce wide range of translucent and opaque finish.
- Hardness - Surface hardness is sufficient for flooring.
- Good Dimensional stability - Its shrinkage/ swelling is less than other hardwoods.
- Sustainability - Consumers can depend on regular supply of this renewable timber source.
- Cost - It is cheaper than most tropical and temperate hardwoods.
- Positive impact on environment - Perennial nature of rubber reduces soil degradation. It also reduces pressure on natural forests and contributes to biodiversity conservation.

b) Weaknesses
Rubberwood has a number of weaknesses which limit its application in value-added products.

- o Biodegradation: It is susceptible to "blue stain" fungus due to its high starch content, brown discolouration due to oxidation of phenolic compounds and beetle attack. These problems can be overcome by early pesticide treatment including pressure impregnation and kiln drying.

- o Poor stability: Prone to twist and bow due to its juvenile nature. This can be alleviated by good kiln practices.

- o Low recovery : Due to branch scars, knobs, tapping wounds, short and small dimension and irregular shape.

4. Yield of rubberwood

The potential yield of rubberwood can range from 100-150 cu. metres per hectare (including branches of diameter 10 cm. and above), depending on stand, clone and branching charateristics.

Sawn logs which are used to produce sawn timber generally have diameter of around 20 cm. The average yield of such logs per hectare ranges from 45 to 57 cu. metre per hectare. Besides stand and clonal vigour, bole height influences the harvestable logs, that is, either two or three pieces of two-metre length sawn log per tree.

Recovery rate of sawn timber from sawn log is rather low, ranging from 25% to 35% due to the small-sized log and irregular shape. Based on above estimates, sawn timber that can be obtained from one hectare of rubber can be as low as 11 cu. metre per hectare to a high of 20 cu. metres per hectare.

FRIM has carried out some studies on yield of sawn log and sawn timber from two popular rubber clones i.e. PB260 and RRIM600. In view of the apical dominance and self-pruning characteristic of PB260 and its greater bole height than RRIM600, the younger (14 yr-old) PB260 had about comparable sawn log sawn timber yields (24 m3) as older (24 year-old) RRIM600 (26 m3).

5. Estimated cost and profit in producing sawn log and sawn timber.

The estimated direct cost items for felling (or stumpage), transport, sawmilling, preservative treatment and kiln drying, as well as prices offered to the estate for rubberwood are derived from personal communications with sawmillers, FRIM personnel and estate managers. These are shown in Tables 1 and 2 overleaf.

Direct costs of stumpage and transport for extraction of sawn logs of around 20 cm diameter usable for sawn timber amounted to RM 990 per hectare. Sawmillers are offering around or over RM 2000 per hectare of rubber (inclusive of free stumpage and clearing). Therefore the total benefit to the estate owner can amount to RM 2690 per hectare from the sale of wood (RM 2000) and saving from the expenditure on felling and burning in situ (RM 690).

For the production of sawn timber, the total cost of the estimated available timber (ie 12.6 m3 or 9 ton) from one hectare of rubber is RM 3285. At the prevailing sawn rubber timber price of RM 627 per cu. metre (RM 880 per ton) the value of sawn timber from one hectare of rubberwood would be RM 7900, which means a profit of around RM 4600. For the sawmiller who pays say RM 2000 per hectare for the rubber wood, his profit after deducting the direct costs of production is still high at RM 2600 per hectare, which is more than what the estate owner gets from the trees.

6. Implications of growing demand of rubberwood on management of rubber plantations.

The direct benefit of rubberwood is the significant reduction of replanting cost. At the average replant cost to maturity of around RM 10000 per hectare, benefit from sale of rubberwood and saving from felling and burning at say RM 2600 accounts for a 26% reduction. Appropriate rescheduling of replanting to cater for year round supply may be advisable.

In addition to consideration for latex yield, it is advisable to place more emphasis to increase rubberwood yield in managing a rubber plantation. This would include

a) choice of clone
- for apical dominance
- self-pruning characteristic
- good bole height.
- good girth increment before and after tapping.
- eg. PB260, RRIM937, PB330.

b) planting density - 480 trees/ha vs. 440 trees/ha.

c) pruning height - prune to 250 cm (100")

d) opening girth - 50 cm vs. 45 cm.

e) root disease control - by trenching in older rubber to prevent spread of disease and loss of stand.

The delay in opening trees at girth of 50 cm against 45 cm is about 6 months. The yield 'loss' involved from this early period is very small (say about 500 kg/ha) especially from smaller girth trees. The extra crop from longer tapping cut from bigger girth trees would more than compensate the above-mentioned yield 'loss' over the tapping life span of around 25 years, estimating to yield 43000 kg in total (ie 25 years at 1720 kg/ha/yr). Furthermore, the basic tapping wage to the tappers is paid on number of trees tapped and not on tapping cut length, thus confers an advantage to the employer. On the other hand, rubber tapper can earn more from better yield by tapping bigger trees.

The method of felling (ie mechanical uprooting) the rubber tree should be specified and adhered to. Contractor would prefer to chain-saw fell to minimise cost of uprooting by bulldozer and damage to the logs. This should not be allowed from the root disease control point of view. Period of felling and clearing should be specified to avoid delay in replanting programme.

The agronomic implication would involve loss of recycleable nutrients from the rubberwood (ie P, K, Ca, Mg). Soil compaction from the heavy machinery is another negative feature especially when soil is wet. Manuring programme should take account of such nutrient loss for appropriate replenishment. Soil compaction could be minimised by avoiding felling and log extraction during wet period.

7. Conclusions

Rubberwood has firmly established itself as one of the major timber in the production of furniture and furniture components, joinery and moulding. It is also a homogenous material most suitable for production of various panel products.

Research and development as well as promotional efforts by various government agencies have brought about international acceptance of rubberwood products, more so in view of the fact that it is a renewable resource with positive impact on environment. Its utilization will also relieve the pressure on natural forest timber and contribute to biodiversity conservation. Future demand is expected to grow. As such rubber plantation should place greater emphasis on rubberwood production and yield instead of latex yield alone.

Table 1
Direct cost of production of sawn rubber log (bigger than 20 cm diameter based on 42 m3 or 30 tons per ha)

Item	Cost per m3 sawn log (RM)	Cost/ha of rubber trees(RM)
Stumpage	16.40 (23)	690
Transport	7.10 (10)	300
Total	23.50 (33)	990

* Figures in parentheses refer to per ton.

Table 2
Direct Cost of Production of sawn rubber timber

Item	Cost per m3 sawn log (RM)	Cost/ha of rubber trees(RM)
Stumpage	55.00 (77)	690
Transport	23.60 (33)	300
Sawmilling	71.40 (100)	900
Preservatives	53.50 (75)	675
Kiln dry	57.10 (80)	720
	260.60 (365)	3285

Assumptions
a) 42 m3 of sawn log/ha (or 30 ton)
b) 30% recovery
ie 12.6 m3 of sawn timber/ha (or 9 ton)

Ong, T. S.