AAR NEWS

October '93

EDITORIAL

Agricultural research has played an important role in the development of plantation agriculture in Malaysia. With rapid industrialisation taking place in the country and increasing competition from our neighbouring countries (chiefly Indonesia and Thailand at present) where cheap labour are in abundant supply, the primary commodity producers in Malaysia are now at a crossroad.

Diversification into value added downstream agro-based industries, manufacturing and property development are now being actively pursued by most plantation companies. Plantation business is still a major contributor to their profits and is expected to remain so for as long as we are able to stay ahead of our competitors. It is therefore vital that our research and development efforts are geared to enhance this competitive edge.

AAR's research programmes have been drawn up specifically to meet the needs of the Principals. Successful transfer of research results to commercial application in the estates involves a lot of hard work and full dedication of all concerned. Happily, AAR has been able to achieve this regularly. A shining example is the AAR Jacket Tapping System which was reported in the Business Times as follows:-

PAGE 2 **NATION** BUSINESS TIMES, MONDAY, MARCH 1 1993

AAR develops jacket tapping system

By Sharif Haron

APPLIED Agricultural Reaearch Sdn Bhd in Sungai Buluh has been developing a tapping system which it said appears to be able to solve the current woes of the rubber industry.

Called the AAR jacket system (AAR for Applied Agricultural Research), the method involves tapping short cuts once in three to four days combined with application of a stimulant enclosed in a jacket attached to the bark,

Stimulation at regular intervals is with improved ethephon whereby an amendment is mixed with commercially formulated ethephon before application, The jacket may be made of plastic or PVC.

Writing in the latent Issue of The Planters a publication of The Incorporated Society of Planters, researchers Chan Weng Hoong and Ong Tee San said the system has been developed to provide an improved method of extracting latex wherein most poshlems faced by the industry can be overcomed through marked improvement in yield, reduced labour required for tapping and extension of economic life of the trees.

The present problems faced by the industry include increasing shortage of labour, high capital cost bringing trees into maturity, and that trees cannot be exploited for much longer than 25 years.

The researchers said the major benefits of the system are the very high yield per tapper, marked reduction in tapper requirement and reduced bark consumption. Owing to the high yields obtained, tappers wages were increased substantially,

"With the higher wage level existing tappers would hopefully be induced to continue working in the estate where they may also enjoy other benefits other indunties may not offer. Ex-tapper's may also be attracted to return to the estates."

The researchers said estate owners and the industry as a whole would benefit from the lower cost of tapping, marked reduction in labour requirement and extension of economic life of trees.

Experiments showed that cost of tapping per kg of rubber was reduced by 1 to 31 per cent. 'Higher labour labour requirement for rubber vis-a-vis oil palms has always been the bane of the rubber industry.

'With a potential reduction in labour of up to 50 per cent, a much leaner and more efficient rubber industry would emerge from its current doldrums of low rubber prices and labour shortage.

"Substantial savings on intangibles such lower medical care, among other things, would be the unseen benefits from a reduction in labour force," the researchers said.

AAR's research activities are wide and varied. A cross-section of the results obtained in 1991 and 1992 are highlighted in this issue of our Newsletter together with some abstracts of our recent Papers. In this way, we hope to keep our associates informed of our research activities. More importantly we strongly believe that feedbacks from our readers will enhance our research efforts and hope to have plenty of them from you soon.

OOI, L.H.

AAR RAINGUARD

The search for an effective rainguard commenced when early results of the AAR Jacket System gave very high yields from prolonged flow times exceeding 24 hours. The objective was to reduce wash-out of late drip by rain.

In March 1992, Mr. K. Anbarasu, senior research assistant in AAR invented a rainguard made from flexible plastic material. Based on early good results, a patent on the device, codenamed 'AAR Rainguard' was filed and a patent no. P1920131 was issued to AAR. Much refinements have been made to the rainguard in the process of development and sale of rainguards to estate commenced in late 1992.

CHAN,W.H.

CONTENTS

RUBBER

PROJECT ON EXPLOITATION OF RUBBER

Following Dr. M.M. Guha's announcement of his "Hypodermic Latex extraction technique," several trials on puncture tapping were laid down.

Highlights of 1991 results obtained from these trials were

1. Ethylene gas gave the highest response followed by ethephon. Acetylene gas gave the lowest response. At high rates of ethylene gas, bleeding occurred on the trunk from around the ninth month onwards.
2. When stimulated with ethephon, very high yields were obtained initially which however declined with time. The bark in the enclosed stimulated area was damaged through frequent application of stimulant, probably causing the yield to decline.

In view of the above and also logistical problems encountered with puncture tapping, conventional short cuts combined with concealed stimulation were evaluated.

Very promising results were obtained and the system has been named "AAR Jacket System". A patent on the system, PI 9201723, is pending.

CHAN,W.H.

APM TRIALS TO REDUCE IMMATURE PERIOD OF RUBBER

Highlights of 1991 results obtained from these trials were

1. Girth of core stumps at 3 years after planting was similar for stumps with initial girths ranging from > *6.5* cm to < 10 cm. As such, where core stump is to be used, it is better to use smaller stumps (with girth of *6.5* cm) in view of lower cost, easier handling and shorter nursery production period (about 1 year from 2-whorl young budding)
2. Ex-young budding and ex-core stump trees grew at about similiar rate at third year of planting in 2 trials (1988,1989 replants). Due to significantly better girthing rate of young buddings in the first two years of planting both materials ended up having about similiar girth after this period. Girth increment was significantly better with fertiliser,but not between level two and one. Mulched or un-mulched trees show no significant difference. However unmulched and unmanured trees have the lowest girth increment.
3. In another trial comparing maxi-budding against the pollarded version (i.e. core stump), large maxi-budding showed significantly higher girth increment. Nursery spacing (100 cm versus 150 cm) and incorporation vs omission of Aquasorb into the planting hole did not result in significant difference in girth increment between both planting materials.

ONG,T.S.

COCOA/COCONUT

COCOA BREEDING/SELECTION

1) Selected PNG Trinitario X Amazonian Crosses

The first two years' yield results from two progeny trials BCA88-21 and BCA 88-23 on Asahi estate (KotaTinggi) indicated that progenies with either SCA 9 or SCA 12 as one of the parents were generally superior in comparison to the other progenies. However, the bean weights of SCA 9 and SCA 12 crosses tended to be small.

(2) VSD resistant clones

The first two years' yield results from trial BCA 88-22 which evaluates 16 selected VSD tolerant clones on Sri Kunak estate (Tawau) ranked HRU 10 (a clone selected from a progeny trial in Torkington estate) as the most high yielding clone. Longer term results are needed before the clone could be released for commercial scale planting.

COCOA AGRONOMY

(1) Pruning

Severe pruning carried out in 1990 to promote the formation of a second storey of branches in trial KAT 89-3 which was set up to compare the performance of single and double-storey cocoa on Sri Kunak estate confirmed that severe pruning depressed yield. Yield was depressed by 26% in 1990 and still lagging behind the normally pruned treatments in 1992 by 14%.

(2) Phosphorus nutrition

A phosphorus nutrition trial laid down in 1989 on Kumansi family soil (Orthic Acrisols) on Sigalong 1 estate's (Tawau) 1980 cocoa showed no significant response to phosphorus (P).The lack of response was mainly due to the residual effect of past manuring prior to the commencement of the trial and the high coefficient of variation of the trial. Methods to reduce the variability are being examined and more data are being gathered.

(3) Manuring

The manuring trial KAT 89-1 on newly ONG,T.S. matured cocoaplanted on Laab family soil (Dystric Cambisols) in Sri Kunak estate showed that manuring increased the yield significantly. However, doubling the current estate fertiliser rates did not improve the yield further. Supplementary foliar application of Grofas Calplus was found to be beneficial during the dry periods only.

COCONUT BREEDING

The Dwaft x Tall (DxT) and Tall x Tall (TxT) hybrid trials on Telok Sengat estate showed that MAWA was still the most high yielding DxT hybrid. West African Tall x Pinggan Pinggan Tall (WATxPPT) was the most promising of the 9 T x T hybrids evaluated.

OIL PALM

OIL PALM AGRONOMY

1. **Maximum yield project :** Currently 3 trials are in progress, the latest trial MF3/92 being set up only in late 1992.

Total destructive sampling of 6 palms from ME 1/90 when palms were 18 months old was completed. Data from this set of maximum yield project trials will provide the basis for verification of the AAR site yield potential prediction model.

2. **Nutrient cycling and balance progamme.** NB3, NB4 and NB5 are trials investigating effects of fertilizer rates on nutrient losses via runoff water and eroded sediments at various sites and rainfall regimes. The 3 trials are located at Selangor, Kelantan and Sabah (Tawau) respectively.

Based on data from NB3 for 1989-1992, annual soil loss ranged from 4-7.7 t/ha/yr depending on rainfall pattern and intensity. Losses of N,P,K and Mg in eroded sediments were generally low in the range of 10, 1, 1 and 0.6 kg/ha respectively.

Mean annual runoff water ranged from 12-20% of annual rainfall.

Nutrients lost annually via runoff water ranged from 10-24 kg N/ha, *1-5* kg P/ha, 10 -34 kg K/ha, 5-25 kg Ca/ha and 1-5 kg Mg/ha/yr. Although there were definite increases in runoff losses of nutrients immediately after manuring, total annual losses were still lower than expected.

Annual losses of nutrient in organic litter amounted to less than 0.3 kg N/ha, 0.02 kgK/ha and 0.02 kg Mg/ha.

Therefore overall total nutrient losses via eroded sediments, runoff water and organic litter were as follows:

20-35 kg N/ha/yr
2-6 kg P/ha/yr
10-35 kg K/ha/yr
2-6 kg Mg/ha/yr

Analysis of rainwater collected from raingauge indicated nutrient returns of the following magnitude annually:-

15 kg N/ha, 1.5 kg P/ha, *5.5* kg K/ha, 2.2 kg Ca/ha and 2 kg Mg/ha.

Todate results indicated that nett losses of the major nutrients were relatively low after taking into account inputs via rainfall. Under the closed canopy of a mature stand, the oil palm appeared to be an efficient and ecologically stable crop from the soil and nutrient point of view.

With limited data (1 year only), results from Kelantan indicated very high runoff losses during the very wet monsoon months of October to December. Runoff losses of 36-57% were recorded over these wet months. Due to unusually dry weather, runoff from NB5 (Tawau) were generally low (<10%) for 1992.

Trial NB6 studied the movement of K in the soil after application in the presence and absence of roots at various microsites within the oil palm ecosystem. Results indicated that after a "pretreatment" (no manuring) period of 1 year, K uptake during this period was highest in the palm circle followed by frond heap areas. Overall mean uptake was estimated at about 2700 g/palm/yr. When K was applied, there was an inexplicable increase in soil K (more than was added) over a 6 month period in all the microsites. The highest increases were noted in the palm circles and interrows. Reasons for this observation are being investigated.

By comparing soil K status in the presence of roots, K uptake over 6 months in the manured plots (lm^2xO.9m) was estimated at 168 g in palm circles,145 g in interrows and 45 g in the frond heaps. This implied that apart from the palm circles, roots in the interrows and frond heaps are also active K absorption sites and application of K fertiliser by broadcasting in the interrows and frond heaps are not detrimental.

Over the same 6 months period, leaching losses of K from unmanured plots without roots, showed highest losses in palm circles (83 g) followed by frond heap (35 g) and interrows (17 g).

These results, together with data from an earlier sampling exercise showed that the traditional practice of applying all fertilisers in the weeded palm circles will result in excessive build up of soil K leading to very rapid leaching of the nutrient into the subsoil. There is also a preferential displacement of Mg 2+ and Ca 2+ by K+ and NH4+ (the other fertiliser applied at high rates commercially) leading also to accelerated leaching of these nutrients. Soil pH was found to drop markedly following repeated fertiliser applications in the palm circles.

KEE,K.K.

IN-FIELD FFB COLLECTION

1. Several in-field FFB collection machines - a) mechanical buffalo (b) Jentani power tiller (c) Wu-cart and (d) Pickit were evaluated during field demonstrations.
2. Mechanical buffalo was the most suitable machine due to the simpliticity of the machine, ease of operation, durability and mobility, particularly in terrace areas.

The established system for using mechanical buffalo consisted of 4-5 men team performing harvesting, frond stacking, FFB and loose fruits collection. Average productivity was 15 tlday/team. Deduction of 10-12% of the team's earning over 3-4 year period was necessary to recover the cost of the machine.

3. For flat terrain and with proper linking road system, the Jentani power tiller was the most suitable but workers require training to operate the machine.

QUAH,Y.T.

IMMATURE OIL PALM CIRCLE WEEDING

Ultra-violet light resistant plastic sheets were used to mulch the palm circles of immature oil palms with the aim of minimising the frequent weeding needed during immature phase.

Moderate success was achieved after 6 months. The plastic sheet mulch was able to suppress weeds in the palm circles but was unable to prevent the legumes from creeping into the palm circles. Ways are being investigated to prevent legumes from creeping into the palm circles.

QUAH,Y.T.

OIL PALM BREEDING

DURA IMPROVEMENT PROGRAMME

Early yield results from trials BD1-86, (3 years), BD2-86 (2 1/2 years) and BD3-87 (1 1/4 years) were available. Although results were considered still preliminary, nevertheless they indicated certain trends.

Dura x dura (DxD) progenies normally are expected to yield lower than dura x pisifera (DxP) progenies because of in-breeding (crossing related individuals) or lack of hybrid vigour. Nevertheless, a few DxD progenies exceeded the yields of the DxP Control crosses. These might be expressions of hybrid vigour e.g. AAR Deli x Felda (IRHO) Deli dura crosses, the parental populations of which might have diverged genetically due to different se-lection histories.

In fruit quality traits, many DxD proge-nies gave very good M/F (mesocarp to fruit ratio) and 0/B (oil to bunch ratio). The latter approaching close to those of DxP. In fact a few DxD progenies exceeded those of DxP in 0/B and some dura palms had better 0/B than normal teneras (T).The better M/F and 0/B characteristics of the DxD progenies reflected the emphasis in selection for these traits in the parents.

Parent dura palm 0105/5 appeared to be a good combiner for high bunch number (BNO) and 0/B which explained why progenies 039, 040, 041, 042 were promis-ing progenies in BD1-86. In BD2-86, progenies with good M/F and 0/B were 001, 004, 0016, 0017, 0018, 0019, 0020 and 0022, while in BD3-87 they were 0121 and 0125.

A total of about 150 palms have been selected from these 3 trials (from mainly the promising progenies) to serve as mother palms in commercial DxP production. In selection, emphasis was placed more on M/F and 0/B as these are highly heritable traits and thus achieving better selection efficiency, rather than on FFB (fresh fruit bunch) yield, as it is poorly heritable and prone to inbreeding/hybrid vigour and environmental influences reducing selection efficiency.

PISIFERA IMPROVEMENT PROGRAMME

Early yield results were available for the following trials:

1. BP1-86 (T x T/P). To obtain improved pisiferas from crosses of AAR's elite ten-eras with introductions from other organisations. 3 years' yield results.

2. BP2-87 (TxT/P). As for BP1-86, 1¾ years' yield results.

Again, as expected, yields of TxT/P progenies were lower than those of the DxP controls, because of inbreeding or lack of hybrid vigour, as the parents of the crosses tended to be related. Of particular interest were the very good M/F and 0/B values of the TxT/P progenies (as the parents were selected for these traits) which greatly exceeded those of the DxP controls.

In selecting TxT/P progenies for use of their pisiferas for progeny-testing and T's for further breeding greater emphases were placed on M/F, 0/B, and low height increment.

Superior progenies shortlisted for use of their pisiferas for progeny-testing and T's for further breeding included 053 (BP1-86) and 0138, 0148, (BP2-86) which had Dumpy-AVROS parents (i.e. 0127/30, 0127/13) in the lineage.

PROGENY-TEST PROGRAMME

1. Trial BT1-85 (DxP). DxP progeny-test of 0127 (Dumpy-Avros) pisiferas.

This trial was originally intended to test almost the full range of 0127 pisiferas to pick out the better combining pisiferas. Unfortunately because of high dura (illegitimate) contamination and high C.V. (coefficient of varation) confidence cannot be placed on the reliabilty of the results.

Based on the results of BT1-85/1 (planted at 8.5 m spacing) which were more reliable, DxP progenies of pisiferas 0127/22, 0127/37, 0127/27 and 0127/4 ranked higher in yield than the Chemara DxP Control while those of 0127/11, 0127/13, 0127/33,0127/24 and 0127/n ranked lower. Statistical signficant dif-ferences between the DxP progenies of the various pisifera groups and the Che-mara DxP Control were generally absent.

2. Trial BT2-87 (DxT). progeny-test of selected AAR teneras and duras for production of elite palms for cloning.

This trial was intended to confirm the choice of D and T parents for further breeding and seed-production and also to select elite T individuals for cloning.

None of the DxT progenies was as precocious yielding as the DxP (AVROS) Control i.e. 0251/8 x 0280/18 . However as the CV was very high, only half of the DxT progenies were significantly less precocious yielding as the DxP AVROS Control. Of the T parents 0010/18 and 0010/28 produced the lowest yielding progenies, while EWS65/4, EWS4O/12, 0126/11 and 0127/30 appeared to have reasonable combining abilities for early yield. Tenera parent 0126/11 appeared to be a particularly good combiner for 0/B. Dura parent 0106/10 appeared to be a better combiner in BNo and 0/B than 37/20.

Teneras EWS65/4, 0126/11, and 0127/ 30 and dura 0106/10 have been featured in further breeding TxT and DxD crosses.

Selection of ortets (palms for cloning) will be concentrated in DxT progenies of 0126/1 1,0127/30, EWS65/4 and 0l06/10.

3. Trials BT3-87 & BT3A-87. DxT progeny-test of introduced teneras.

This trial aims to confirm the choice of tenera parents introduced from other organisations for use in future breeding and seed-production.

None of the DxT progenies yielded better than the DxP controls for the first 21 months. Duras 0250/9 and 0248/49 appeared to combine better with 0406/19 tenera than 0105/27 and 37/20 duras with 0406/19, giving progeny yields not statistically different from the DxP controls. In 0/B too, 0250/9 and 0248/49 duras appeared better than 37/20 and 0105/27 in combining with 0406/19.

In BT3A-87 , only one progeny, 0106/ 61 x 409/28, exceeded the DxP (AVROS) Control i.e. 0251/8 x 0280/18 in the first 21 months' yield. There were

no significant differences among the progenies because of the high C.V. Except for progeny 0120, all the progenies were better than the DxP Control in 0/B.

To differentiate the combining abilities of different tenera parents. this trial will have to be combined with other trials i.e. BT3A-87, BT2-86. This will be done later.

CLONAL TESTING PROGRAMME

1. Trial : BCT1-86 : Preliminary clonal screening trial 1.

This trial tests the first clones obtained from AAR Tissue-Culture Lab. All the clones were derived from seedlings.

All clones were normal bearing. Based on 2 1/2 years' yield results, only clone S36 exceeded the DxP (AVROS) Control i.e. 0251/8 x 0280/18. Differences were not significant among the treatments due to the high C.V. when analysed as RCBD with missing plots.

In terms of 0/B, 536 was also better than 0251/8 x 0280/18. Clone 36 has been recloned for propagation and testing.

2. Trial BCT2-86 : Preliminary clonal screening trial 2.

This trial evaluates AAR's seedling and ortet clones against clones from PORIM and Bakasawit.

Only the Bakasawit clone was mantled. Except for Clone P8, which appeared infertile but not mantled, none of the other clones was significantly different from the DxP (AVROS) Control in 2 1/2 years yield. Clones Pl0 (PORIM) and 208 (AAR ortet clone) were equal to the DxP Control while others were slightly below.

Clones P12 (AAR/PORLM), S42 and 208 were significantly superior to the DxP Control in 0/B. Clone 208 recorded close to 30% 0/B in 1990. The reason for the slight drop in 1991 was not clear.

Clones P12 and 208 have been recloned for propagation and testing.

3. BCT3-87. Clonal test of IRHO ortet clones.

IRHO (French oil palm research group) has claimed to have superior cloning technique and superior clones.This trial aims to verify their claims.

Three of the IRHO clones have shown mantling. This was particularly severe in LMC88. PORIM Clone Pl0 was also mantled.

Three IRHO clones, LMC063, LMC074 and LMC088, appeared to be as precocious yielding as the DxP (AVROS) Control.

In terms of 0/B, clones LMC090, Pl0 and LMC074 were comparable to the DxP Control.

The IRHO claims did not appear to be substantiated from these initial results of their early clones.

SOH, A.C.

ASYSTASIA INTRUSA

A BIOLOGY

Field trials at Balau Estate confirmed 1990-9 1 pot trial results and summarised as follows:

1 Flowering - Asystasia would flower in about 45 and *55* days under open and shaded conditio respectively.

2 Seed production - 40-60 million seeds per hectare of Asystasia were produced after three months under open conditions and much lesser quantity of 5-15 million seeds under shaded conditions after six months.

3 Maximum growth situation - Asystasia growth reached maximum growth situation in about 4-5 months and produced 5-7 tonnes of dry matter per hectare (leaves/branches and roots) under open conditions and 3-4 tonnes of dry matter per hectare under shaded condition.

Table 1 : Nutrients immobilised by A.intrusa

	kg/palm (equivalent 136 sph of oil palm)			
Growth Condition	Ammonium sulphate	Rock phosphate	Muriate of potash	Kieserite
Open	5.3	0.5	3.9	0.8
Shaded	4.2	0.4	3.0	3.7

After maximum growth situation, older leaves dropped and Asystasia stems collapsed to form postrate growth pattern

B SEED GERMINATION

1 A series of laboratory germination tests showed that Asystasia seeds germination was greatly hastened by increase of temperature.
2 Fresh seeds germination of over 95% was achieved in two weeks at 40°C.
3 Similar germination results were also obtained when fresh seeds were heated to 75°C for 20 minutes or stored under dry conditions at 28°C for 30 days.
4 The germination results concurred with observations of fairly uniform blanket Asystasia germination in the fields, usually after a dry period followed by heavy rain.

C SOIL SEED BANK

Field trials indicated that it was possible to exhaust almost all viable Asystasia seeds in the field in about 5-6 months, provided all ground vegetation were blanket sprayed initially.

D ASYSTASIA CONTROL

Germination results suggested that control of Asystasia is possible if the following spraying regime was followed:

1 Blanket spray high infestation area during dry spell (January to February)
2 Respray at 45 days interval or at onset of first flowering for five rounds.
3 Spot spray for Asystasia that had flowered in between rounds.

QUAH, Y.T.

SOCIAL AND PERSONAL

Congratulations to:

* Tey Seng Heng and Khor Geak Peng on the birth of their 7 lb. 8 oz. son Yen Khai on 8- 8-93 at 8.30 pm. Take note of the many eights. Pronounced in Cantonese, eight means prosperity.

* Denney Kassim and Roslina Yaakub who tied the knot on 24/10/93.

* Goh Kah Joo on being awarded the MSc degree in Biological Computation with distinction by University of York where he attended a one year course in 1991/92 sponsored by AAR.

Welcome to:

* Hor Thim Yoon who joined us on 15th May, 1993 as assistant plant breeder. He graduated from University of Malaya with a 2nd Class Honours (Upper) in Genetics in 1992. Hor is currently based at AAR Balau Estate Sub-station.
* Md. Noor Mazlan who joined us on 12/8/93 as Research Assistant.

Staff Promotions/Confirmation:

Name	From	To	w.e.f.
Che Nor Azman Alias	Research Recorder	Technician III	1/6/93
Chin Tong Lai	Research Assistant	Research Asst.	1/9/93
Kumar Krishnan	Research Recorder	Technician III	1/1/93
Lily Loo Ah Lay	Research Clerk II	Research Clerk I	1/1/93
Sauna Haripen	Statistic Operator	Research Clerk III	15/3/93
Selvam Perimal	Research Recorder	Technician III	1/8/93
See Choon Mooi	Research Clerk II	Research Clerk I	1/1/93
Zulkephli Ghani	Research Recorder	Technician III	1/1/93
Santhakumar Krishnan	Research Technician(NC)	Research Asst.	1/9/93

BALAU ESTATE FIELD VISITS

AAR staff had a "Field Day" at Balau on August 14, and acted as "guinea-pigs" in the rehearsal for the actual AAR Field Visits on August 22 and 23. The company adjourned for a picnic at the nearby Sg. Tekala Falls after a satay lunch. About 100 participants from TAIKO and 30 from Boustead visited the AAR trials and demonstrations. We wish to take this opportunity to thank all those who helped to make the Field Day a success.

At the DxP seed production station (AAR Field Visit)

Stock up for the hard work ahead (AAR Field Visit)

ABSTRACTS

(Full papers will be sent on request.)

Soil Fertility Status of Some Common Soils in Sabah, Malaysia.

Goh K. J., Chew P. S. and Kee K. K.

Abstract presented at the MSSS Soil Conference, Penang, l9th-2lstApril, 1993.

Since 1980, we have soil surveyed approximately 113,000 hectares in Sabah on semi-detailed to detailed scales. A total of 837 samples were collected from the soil horizons in the soil pits. These samples represented 60,000 hectares and covered 17 FAO soil units and 35 soil families.

In the A horizon, the average soil pH was 4.9, organic Cwas 2.1%, total N was 0.22%, total P was 295mg P kg', Bray-2 P was 14 mg P kg', exchangeable K was 0.36 cmol kg-', exchangeable Mg was 7.2 cmol kg', exchangeable Ca was 3.6 cmol kg', CEC was 16 cmol kg-' and base saturation was 60%.

The nutrient contents in the B horizon were lower for all the above soil properties. The declines ranged from 10% for soil pH to *85%* for available P. In the C horizon, soil pH, exchangeable Ca and CEC were higher than the A horizon while the other soil properties were lower.

The coefficient of variations of soil nutrients within each soil family ranged from 1 to 333%. The most uniform was soil pH and the most variable was exchangeable Mg. These large variabilities were related to the parent materials, genesis, location and vegetation.

This study clearly demonstrated the need for a more detailed soil classification system in Sabah.

Fertiliser Management in Oil Palm

Chew P.S., Kee K.K., Goh K.J., Quah Y.T., Tey S.H.

Abstract of paper presented at the International Conference on Fertiliser Usage in the Tropics, Kuala Lumpur, 24th-27th August, 1992.

The oil palm industry spends very large sums of money annually on fertilisers. Fertilisers form the major variable expenditure item in production costs and also determine largely the crop production levels. Considerable research on oil palm nutrient requirements and their responses has been carried out. A system to formulate fertiliser programmes and predict yield responses to N and K fertilisers has been drawn up (PORIM Fertiliser Recommendation System). This system is based on multiple regression analysis of N and K fertiliser responses to palm and site characteristics. The system is evaluated for some widely grown soils together with another system for formulating annual fertiliser requirements of mature oil palm based on nutrient balance.

The predictions for maximum and actual site yields were also evaluated. The results indicate the need for further improvements to the PORIM system for fertiliser recommendations and yield predictions. Detailed studies on the important parameters affecting nutrient requirement and yield response such as slope, rainfall, silt content and drainage are needed. The results could possibly be recombined to formulate another predictive model. The nutrient balance approach appeared to be less susceptible to severe nutrient imbalances over the medium term. High yield achievement will probably require much increased nutrient inputs. Further research is required to increase fertiliser efficiency and ensure that excessive fertiliser applications are avoided. This can be achieved through more precise yield predictions, fertiliser recommendations and better estimates of fertiliser efficiency and nutrient availability from the soil. Residual fertilisers from past applications and internal nutrient recycling within the palms need to be taken into account. More advanced research techniques including use of radioisotopes are required now. The results and efforts to draw up more precise fertiliser rates will help to reduce the problems with fertiliser applications. Use of mechanised fertiliser spreaders where possible will be very important to overcome labour scarcity problems. If recommended practices on fertiliser applications are followed, risks of pollution of the environment from fertiliser applications in oil palm will be minimal.

The root system of the oil *palmIElaeis 2uineensis*, Jacq.) I: A modified soil core method for root study

Goh K.J. and Samsudin A.

Abstract of paper published in Elaeis 5 (1): 1-11 June 1993

Studies were conducted on a simple technique to quantify oil palm roots using the soil core method. The modifications to existing technique involved the use of *5%* sodium hexametaphosphate (Calgon), 0.5 mm mesh sieves and a microwave oven.

A 5% solution of Calgon was found to have no significant effect on the length or diameter of oil palm roots. It was effective in dispersing Rengam series soil (Typic Paleudult). After 12 hours of soaking in 5% Calgon solution, only 8% of the soil aggregates remained larger than 0.5 mm in diameter. This reduced the time of elutriation to about 10 minutes. Loss of tertiary root during the washing process was 3 **%.** None of the secondary or primary roots passed through the 0.5 mm sieve owing to their larger diameters.

Drying did not significantly change the length or diameter of the secondary roots or the length of the tertiary roots. However, the diameter of the tertiary roots was significantly reduced. The diameter (Y) of the fresh tertiary root could be estimated from the diameter (X) of the dry root by the linear equation; $Y = -0.39 + 1.34 x$ ($r^2 = 0.94$)

The oil palm roots could be dried in 20 minutes instead of 24 hours by using a microwave oven at low to medium power setting. The sizes of roots did not influence the time of drying when a microwave oven was used.

The root system of the oil palm *(Elaeis Guineensis*, Jacq.) II: Indirect estimations of root length, diameter and surface area

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Direct measurements of oil palm root length, diameter and surface area are time consuming and laborious in the absence of a sophisticated image analyser. A study to examine indirect estimations of these root parameters with and without elutriation was therefore conducted.

The results showed that two non-elutriation methods (which were extensions of Tennant's formula and Drew and Sakers' method) did not provide accurate estimates of root length per soil core. The correlations between direct measurements of root length and lengths obtained by each of the above methods were low.

Root length per soil core could be estimated from root dry weights by regression if the roots were categorized into different diameter classes: primary roots >7 mm (XI), 4-7 mm (X2) and <4 mm (X3); secondary roots> 1.2 mm (X4) and < 1.2 mm (X5); and feeder roots (X6). Their coefficients of determination (r^2) ranged from 0.86 to 0.95.

Step-wise regression analysis showed that total root length (cm) per soil core (Y) could be estimated by the equation:

$Y = 15.8 + 14.2\ X3 + 95.6\ X4 + 364.9\ X5 + 394.6\ X6$ with an r^2 of 0.91.

Root diameters and surface areas were also highly correlated with root dry weights.

Manganese Deficiency in MatureOil Palms in Malaysia:deficiency symptoms, foliar levels and responses

Kee K.K., Chew P.S. and Goh K.J.

Abstract of paper presented at the 1993 PORIM International Palm Oil Congress (PIPOC), Kuala Lumpur.

Manganese deficiency in mature oil palms has not been reported before. Despite generally low Mn levels in many Malaysian soils, Mn deficiency has only been documented in rubber of the major plantation crops.

During a visit to an estate in South Johor,very prominent small patches of chlorotic palms with small canopies and limp fronds were noted in 2 blocks (8 and 13 yr. old palms). Micro-nutrient deficiency was suspected and leaf samples of apparently 'deficient' palms and nearby 'normal' palms showed normal range of nutrient levels except for Mn. A detailed programme including 2 small Mn504 application trials were drawn up to

a) characterize the micronutrient deficiency symptoms and establish critical levels if possible,
b) ascertain reasons for appearance of the deficiency and
c) assess corrective techniques and the benefits of corrective measures.

In severely deficient palms, canopies were small, chlorotic and lacking in vigour. Fronds were shortened and dieback of pinnae from the tips was common on the lower half of mature fronds. Closer examinations revealed interveinal chlorotic spots and lines, becoming necrotic with increasing severity. In very severe cases, unopened fronds and spears become necrotic and dieback of whole spear and young fronds occurred. Foliar analysis indicated that pinnae of Frond 1 and 9 were more sensitive as indicators of Mn status and tentative critical levels in Frond 9 were as follows

< 10 ppm deficient,
10-20 ppm marginal,
> 20 ppm adequate.

The mean Mn concentration (Frond 17)of the palms at the start of the trial was 11.9 ppm. 150 g MnSO4 per palm applied on palm circles + 60 g MnSO4 as foliar spray gave highest foliar Mn concentrations (36 ppm) after 8 months. However 300 g MnSO4 per palm applied in palm circles was also as effective (30 ppm) and gave higher foliar Mn after 1 year. The leaf levels of the 2 treatments were 87 and 110 ppm respectively compared to the control of 24.3 ppm after 1 year.

Despite no Mn application, mean Mn levels in control plots increased gradually with time and was 60 ppm three years after the trial started. In contrast Mn504 treated plots had Mn levels exceeding 130 ppm and ranging up to 225 ppm.

FFB yield records in the first 18 months after treatment indicated higher yields in all treated plots.

The yield difference between control and treated plots decreased with time and was similar or better than treated plots by the end of the 3rd year. This is not unexpected as foliar Mn levels in control plots had also shown a corresponding improvement.

The observed Mn deficiency, being localized and apparently transient was probably induced by pH changes as a result of GML applications on the very sandy colluvial soil of the observed area.

Application of 300 g MnSo4 (as solids) in palm circles or 150 g MnSO4 (as solids) + 60 g MnSO4 as foliar spray are effective to correct for leaf Mn status within 8 months. Full recovery of canopy size, colour and vigour took up to 3 years.

Effects of NK fertiliser on soil pH and exchanaeab!e K status on acid soils in an oil palm ecosystem in Malaysia

Kee K.K., Goh K.J. and Chew P.S.

Abstract of paper presented at the 3rd International Symposium Plant Soil Interactions at Low pH, 12-16th Sept f1993, Brisbane, Australia.

The oil palm requires high nutrient inputs especially N and K for sustained high yields. N and K fertiliser rates for mature commercial plantations vary from 110 to 185 kg N and 185 to 300 kg K ha-' yr'. On Musang series (Typic Paleudult) soil, the conventional practice of applying fertilisers within a circle of about 2 m radius around the palm base resulted in marked declines in soil pH and substantial buildup of soil exchange-able K within the application site. After 7 years, at the highest rate of application, surface soil pH was 3.8 compared to 4.2 in control plots. Exchangeable K increased four folds. These changes were evident to a depth of 120 cm. Within I month after application of NK fertilizers surface soil pH declined from 3.8 to 3.4 and K moved to a depth of 60 cm. On Rengam series (Typic Paleudult) soil, the movement of K was monitored in 1 m^2 plots to a depth of 0.9 m, in the presence and absence of roots. K uptake by the palms was mainly from the palm circle and frond pile areas. Fertilisers significantly improved K uptake from the interrow areas. Losses were more rapid in the palm circles followed by frond heaps, interrows and harvester's paths. To minimisè'the undesirable effects of low pH, risk of leaching losses and to improve fertiliser efficiency, broadcasting of the fertilisers is advocated in mature oil palm plantation.

K Nutrition for Mature Oil Palm in Malaysia

Goh K. I., Chew P. 5. and Kee K. K.

Abstract of paper presented at the Workshop on K Nutrition for Oil Palm in Indonesia, 4th October, 1993, Medan, Indonesia.

The oil palm accounts for 59% of fertiliser use in Malaysia. In established estates, 30 to 60% of the manuring cost of mature oil palm is on K fertiliser. Therefore, to maximise yield and profit, K fertiliser must be used at its highest efficiency. To achieve this, we need to have a proper understanding of K fertilisation, K responses, K budget and K use efficiency. This review examines recent data on these aspects of K nutrition of mature oil palm in relation to their possible manipulations to maximise K use efficiency and yield.