AA RESEARCH NEWS

May, 88

EDITORIAL

THE THIRD CROP: COCOA

Cocoa, the third principal plantation crop in Malaysia after oil palm and rubber, raises mixed emotions in **Planters**. The prospect of working in Sabah is one aspect but to many **Planters**, the new crop with its reputation of being very sensitive, difficult, labour intensive and in some cases, unpleasant to work in because of the numerous mosquitoes present, raises feelings of apprehension and worry about being able to do a good job in today's difficult labour situation. Some committed **'Cocoa Planters'** however relish the challenge and claim that the crop separates the 'men' from the 'boys'. We do not dispute the claim and our observations on fluctuating fortunes of cocoa estates and frequent changes of **Managers** appear to confirm that claim.

Policies of rotating staff in estates and to and from Sabah (deemed necessary) and the low hectarages of the crop planted resulted often in cocoa areas managed by **Planters** who were seeing and handling the crop for the first time. With different experiences, learning abilities and attitudes based on proportionate hectarage importance to the estate, cocoa areas are often managed with very variable expertise and interest with the consequent variable results. This was probably inevitable given the stage of development of the crop and the experimental/observational attitude taken on the crop. However now that cocoa is fixed as a third crop with significant hectarages planted and faced with prospects of a long period of low prices for the commodity, it may be useful to reflect on the management needs for the crop.

There is common concensus that 'high' yields of 1500–2000 kg/ha/year from the crop are possible in Malaysia even outside the Tawau area, with the current planting materials and knowledge of the crop. Individual fields, smallholders and experimental fields have been known to regularly achieve such results but on larger scale, results have been usually much poorer. While some severe technical problems such as severe disease outbreaks of **vascular streak dieback** (VSD), the **cocoa pod borer** (CPB) and long drought (as in 1983) have been major contributory factors, there is little doubt that variable managerial ability to deal in sufficient detail with the shade and planting requirements, pest and disease situation and highly variable seasonal labour demand for harvesting and other planting practices, has been an important reason for the poorer results seen. As plantation type large scale development of monoculture cocoa areas is a 'new' game, the planting systems and management structures adopted were modified from existing practices from other countries, other crops, experience todate and theory. New problems were tackled as they cropped up, and the **Industry** stumbled along.

This current fluid stage of development of the **Industry**, when many practices adopted have little formal proof and research developments are still scanty, allows good scope for the **Managers** on the ground to develop and formulate improved and more efficient planting practices to achieve the desired results.

However, with stacks of problems and work to be done, some **Planters** hope for instant cures and miracles to wipe away their problems. The very keen and impatient grappled with the magic, half-science and speculative ideas occasionally encountered especially in Sabah, sometimes unfortunately rather disproportionately to the omission of the basics of good sound management practice.' Seeing and learning about the crop from others is part of the learning process. However great care must be taken not to be carried away by all sorts of ideas not soundly founded.

Good and sound ideas should be allowed chances for fruition to develop the **Industry**, while speculative ideas must be dealt with in correct perspective and not be allowed to unduly distract the **Management**. The priorities of ensuring strong planting materials from the nursery, full productive stand as early as possible after planting, timely planting practices, early detection and control of pest and diseases, clean and regular crop harvesting hold for all crops and the **Management** must give emphasis to ensure that all this is achieved in the cocoa estate. The practical, labour and logistic problems have to be closely observed, thought about, discussed and worked on for improvements to be achieved in the Industry. As in everything the practices and recommendations formulated cannot be successful for long without good science and basic knowledge of the crop and its characteristics. AAR will hopefully be able through its research programmes and close rapport with **Managers** be able to help work out solutions to some of the outstanding problems now faced by the cocoa management.

Chew, P.S.

Highlights of Some Agronomic Problems in the Sandakan Cocoa Estates.

INTRODUCTION

The AAR cocoa team visited some cocoa estates in the Sandakan region in February/March 1988.

This report summarises some of the agronomic problems encountered. We feel that it is useful to highlight them here as they are either common in the estates visited or they provide useful lessons to be learnt.

An attempt is also made to put forward AAR's views and suggestions to overcome the problems. The recommendations made should be read in conjunction with the relevant circulars on the subject where applicable. Specific applications should only be followed after discussion with your PA/VA and agronomist.

1. Planting materials

1) **Hybrid seeds**

In the past, when demand for hybrid seeds was high, it was not uncommon to hear **Managers** complaining about delays in delivery and receiving hybrid progenies which did not conform to what were ordered. The problem is not as severe now but they do still occur.

HIGHLIGHTS

To minimise such problems, **Managers** are advised to:–

(i) schedule seed delivery to coincide with the main cropping months i.e. Feb.–May. and Sept.–Dec. The best delivery months are normally Mar.–Apr. and Oct.–Nov.

(ii) place seed orders well in advance, say a year ahead and obtain a written confirmation from the suppliers. Remind the suppliers nearer the date of delivery.

(iii) specify the parentage of the hybrid seeds required and order only the recommended hybrids. Hand-pollinated (capped) seeds are purer and hence better than open-pollinated seeds. The purity of seeds from assisted pollination (the so called hand-pollinated uncapped) has yet to be checked and hence cannot be assured and assumed to be comparable to hand-pollinated seeds.

2) **Clones**

Estates embarking on big-scale clonal plantings but which do not have adequate supply of budwood of their own, often end up paying dearly for the expensive and often more-than-a-day-old and hence inferior budwood resulting in lower budding success and disruption in budding/planting schedule.

Recommendations

Always establish a budwood garden in the form of a small-scale conventional commercial planting at least a year ahead to supply the required budwood. Plant at least 10 recommended clones in repetitive sequence of 4 rows per clone. Each should add up to about half a hectare.

2. Nursery

1) **VSD susceptibility**

Nurseries were still sited too near to the existing cocoa fields with very high VSD pressure. Very high VSD loses (30–50%) were reported in one of the nurseries which was only 3-months old and where **Bayfidan** was applied from first flush but stopped after a short period because of phytotoxicity.

Recommendations

Nurseries should never be sited near areas with high VSD inoculum except when there is absolutely no choice. Isolation with a barrier zone of at least 200 m wide supplemented by **Bayfidan** weekly spraying at 2.5 ml product to 10 l. water and very strict culling, is still the best bet.

One should not rely solely on chemical control and should take a very serious view of the fact that it is very difficult or impossible to detect the disease in its early stage (it usually takes about 2 months for the symptoms to appear). Many plantings have been known to end up in disaster because of such error.

For wrongly sited nurseries, the following are suggested:–

(i) spray the nursery with **Bayfidan** at 2.5 ml product in 10 l. water weekly

(ii) spray a 200 m belt of the adjacent cocoa field with **Bayfidan** at 5 ml product in 10 l. water weekly

(iii) erect a 3 m high artificial barrier of non-woven plastic to separate the nursery from the sources of inoculum.

(iv) weekly culling to remove and destroy all VSD infected plants.

2) **Bayfidan toxicity**

Two nurseries on different estates suffered severe stunted growth which is characteristic of **Bayfidan** toxicity. But another nursery on one of the estates where phytotoxicity was noted was apparently unaffected although strict adherence to recommended dosage was claimed.

Obviously, the range in tolerance to **Bayfidan** in young cocoa seedlings may be very narrow.

A good nursery

A good planting

V.S.D. – free buddings

Recommendations

(i) The recommended rate of 2.5 ml **Bayfidan** product to 10 l. water requires very accurate measurement because of the very low volume of fungicide involved. Mixing in bigger volumes to reduce margin of error, say 25 ml **Bayfidan** in 100 l. water is suggested.

(ii) Fungicide mixture should preferably be prepared by a staff member who is well versed in the measurement and calibration of the fungicide.

(iii) Avoid over-spraying particularly on very young plants. Direct spray to unhardened flushes and spray to wet only.

3) Poor recovery and inferior buddings

Apart from the budder's skill, VSD infection and budwood quality which are fairly obvious factors having bearing on the recovery of buddings in the nursery, the other commonly overlooked causes of poor nursery recovery and infe- buddings noted in some of the estates visited were small polybag size, close spacing and poor drainage.

Recommendations

The obvious thing to do is to identify the deficiencies and correct them accordingly. With regard to the last three factors, one should not try to reduce cost by cutting corners and risk ending up with inferior planting materials which is really "penny-wise and pound-foolish".

Always insist on very high nursery standards to ensure that one starts off well in the field. There is really no substitute for starting off with very well-grown, vigorous and healthy planting materials.

(i) Always use adequately big polybags (eg. 30 cm X 45 cm) which are able to support good nursery growth for up to 9–12 months and give greater flexibility in planting schedules.

(ii) Never economise on space. The bags should be spaced at least in twin rows separated by a 0.8 m gap for access and to provide adequate space for good growth. It is preferable to space them at 0.3 m X 0.6 m for 9 months in the nursery.

(iii) Always plan ahead to ensure that foreseeable problems do not crop up when it may be too late or too difficult to correct.

Drainage was notoriously inadequate in most of the nurseries visited.

3. Low stand of productive plants

Table 1: Census on cocoa stand in a 1984 planting

Category of plant	%
Productive	33
Poor to not productive	54
Vacant	13
Total	100

This is probably the biggest problem encountered in most of the estates visited. A detailed census of a 5 ha block of a 1984 planting in an estate provided a very revealing figure which is not uncommon in areas where yields are poor (Table 1).

The major problems noted in the block concerned were:–

(i) high planting failure caused by VSD

(ii) poor drainage

(iii) debilitation by VSD, stem borer, pink and white thread blight diseases

The same may be said for the other poor areas on the estate and elsewhere. The other problems that may be added on to the list of probable causes of low productive stand were:–

(i) debilitation by stem canker, *Emposca* plant hopper and numerous other leaf/shoot pests.

(ii) damage by falling timber

Recommendations

The obvious thing to do is to identify the problems and take immediate steps to upgrade the productive stand to about 1000 plants/ha.

Upgrading of productive stand in the problem area is not a simple task particularly in the Sandakan area where pest and disease problems are more severe. An integrated approach reinforced by a determined effort will be necessary.

The first step is to remove the basic field constraints. The most obvious problems noted were poor drainage in the low-lying and extensive flat or slightly sloping areas and high stand of jungle trees in the under-jungle areas.

Complete removal of the jungle trees in the latter areas prior to rehabilitation is a must as felling jungle trees at a later stage will negate much of the earlier efforts.

Next, a decision has to be made on whether to supply or to rehabilitate (restore/rejuvenate) the existing plants. A two-pronged approach is probably the best on current knowledge i.e.

(i) in Sandakan areas where VSD problem is normally more severe, it is preferable to supply all the vacant points and replace the very poor plants which cannot be improved readily.

(ii) to rehabilitate plants which have a fair chance of recovering i.e. usually with a reasonably developed main stem and preferably, at least, fairly developed branch framework.

Some subjective judgement and a great deal of on-the-ground experience are obviously required to categorise the plants in the marginal categories.

1) Supplying

Very obvious differences were noted between the success of seedling and budding supplies in most of the estates visited. There is little doubt now that buddings are far superior to seedlings as supplies in initial growth, vigour and survival.

Past experience indicated that in the Sandakan area supplying with seedlings usually ended with poor results. The main cause of the supplying failure was VSD.

Results obtained in the past two years indicated that in areas where supplying with seedlings had failed previously, it was possible to supply such areas with VSD tolerant buddings and bring them to maturity within two years from planting.

The salient points that must be observed are:–

2) Planting materials

Use only VSD tolerant buddings. Clones recommended currently are listed in Appendix 1. Again, one should start off correctly right from the start i.e. plant only really well grown (9–12 months from sowing), vigorous, VSD-free and fully-hardened buddings.

It is also advisable to supply during the drier part of the year and to complete the supplying well before the main wet season when VSD pressure is highest.

3) Post-planting practices

Major hazards are VSD, leaf eating pests, herbicide spray drift damage and lack of follow-up in field upkeep. One has to follow and supervise a comprehensive management programme religiously to obtain good results in the problem areas.

The suggestions are:–

(i) *"Sarong"* all supplies. The sarong is primarily to reduce moisture stress on planting out, but its cost usually pays for itself in the form of lower incidence of pest attack (including VSD), less weed competition and herbicide spray-drift damage and possibly, more erect growth of buddings thus obviating the need to stake the buddings.

(ii) monthly *manuring* (schedule 1 attached), *hand-weeding* and *pest control campaign* for 12–18 months depending on the growth of the plants and the level of pest activity. The same upkeep gang should preferably carry out all the following monthly programme at each round:–

(a) manure as per Schedule 1

(b) hand-weed planting circle

(c) soil drenching with 200ml (first 3 months) to 400 ml (fourth month onwards) solution of 10ml **Bayfidan** 250 EC in 10 1. water to control VSD.

(d) if leaf-eating pest is a problem, apply 15g **Furadan** 3G per plant in the planting circle.

(v) If required, further supplementary spraying of a mixture of insecticide (eg. 0.1% a.i. **methamidophos** or **acephate** or **dimethoate**), fungicide (5 ml **Bayfidan** 250 EC in 10 1. water) and 0.2% **AAR Foliar Green** (20g in 10 1. water) may be considered.

(iii) **Mulching** where EFB (empty fruit bunches) or other mulches are available. The planting circle (outside the sarong) should preferably be mulched with 5 bunches of EFB or its equivalent.

(iv) *Weed control.* The areas surrounding supplied points should be sprayed with **glyphosate (Roundup** at 20 to 40ml per 10 1. water depending on amount of shade, weed species and density) if grasses are the dominant weed and **paraquat** (2 rounds at 70ml in 10 1. water) for broadleaves prior to supplying. Also keep the planting strip weed free with regular spraying of **Roundup** or **paraquat** at all times.

4) **Rehabilitation**

Poor but rehabilitable cocoa should be placed under intensive care on a yearly basis but review the position regularly (say quarterly) to check progress and whether any changes in inputs are required.

The agronomist-in-charge should check the area in detail to draw up specific recommendations including manuring which should be frequent and high and very high standard of pest and disease control enforced over the rehabilitation period.

Where run-off losses are high, adequate conservation measures such as construction of conservation terrace and planting platform, mulching and leaving strips of soft grasses in the interrows should be considered.

Planting failure

Planting failure is now less common but one should not be complacent.

The main culprit in the past was VSD but losses due to poor etiolated seedlings, inadequately prepared shade and wrong planting weather could occur. Leaf eating pests could become a big problem as well if they are not adequately controlled.

Recommendations

(i) ensure that the nursery is free of VSD as far as possible

(ii) enforce very strict culling in the nursery to rogue out all diseased and poor growing plants.

(iii) plant only well-grown, vigorous, healthy and fully hardened plants. Plants are poor at planting if they require to be staked at planting-out.

(iv) keep new plantings as free from VSD for as long as is feasible (12–18 months).

It is recommended that all VSD infected plants be removed and replaced with healthy plants at monthly intervals in the first 6 months after field planting.

Plants older than 6 months may be cut back to 10cm beyond the brown streaking.

(v) treat the 200m barrier belt with 2-weekly spray of **Bayfidan** 250 EC at 5ml in 10 1. water in the VSD pressure area, monthly soil drenching with 200ml (first 2 months) to 400ml (4th month onwards) solution of 10ml **Bayfidan** in 10 1. water is preferred.

(vi) where leaf insect pest is a problem, spray any one of the following insecticides at 10–14 days' intervals.

(a) 0.1% ai **methamidophos** eg. **Tamaron** 50 EC at 20ml in 10 1. water

(b) 0.1% ai **dimethoate** eg. **Rogor** 40 EC at 25ml in 10 1. water

(c) 0.1% ai acephate eg. **Orthene** 75s SP at 13g in 10 1. water

Always incorporate a foliar fertiliser eg. AAR Soluble Green at 20g in 10 1. water into the insecticide mixture.

The insecticide may be incorporated into the **Bayfidan** mixture for spraying where appropriate.

(vii) all big vacant gaps (more than 5m) and very poor plants should be supplied as soon as the planting has been complete and a second round of re-supplying carried out within 6 months to ensure a uniform and even stand of good cocoa.

Damage by falling timber

This is mainly a legacy of inadequate supervision in the under-thinned jungle plantings or misguided management. Some damage resulting from delayed thinning of *Gliricidia* were also noted.

Recommendations

(i) never plant under thinned-jungle unless minimal damage can be assured by leaving only small regenerated trees and there is little other choice.

(ii) in rehabilitating the under thinned-jungle plantings, all jungle trees must be felled completely in one go prior to any major attempt at rehabilitation.

(iii) **Gliricidia** trees should be thinned to the final stand required as soon as the circumstances permit. Where thinning is delayed, poison the trees and precision-fell them when the trees are dried to minimise damage to cocoa.

6. Debilitation by P & D

There are too many pests and diseases which can debilitate the cocoa planting if not controlled. Only three are listed here:–

1) **Stem borer** *(Zuezera coffeae)*

Stem borer damage has increased markedly in most of the areas.

A census in two plantings (1984 and 1985) in an estate indicated that stem borer damage was indeed high (Table 2).

Table 2: Stem borer damage census

Year of planting	% of plants with damage			Mean number of holes/ affected plant		
	fresh	old	Total	fresh	old	Total
1984	11	7	18	2.91	2.33	5.24
1985	1	2	3	1.00	1.00	2.00

Recommendations

(i) where the pest incidence is low, the pruning gang should be able to control the pest in conjunction with the pruning operation satisfactorily.

(ii) where the pest activity is high, another gang should be trained to control the pest. 2–4 weekly treatment rounds are required.

(iii) the recommended treatments are:–

(a) inject all new entry holes on the main stem and branches with an insecticide mixture and then cover them with mud. The pest normally bores towards the terminal end.

(b) incorporate a fungicide into the insecticide mixture if stem canker is reported because the disease often arises from the stem borer holes.

(c) small twigs and branches that are attacked by the stem borer should be pruned, split-open and the pest destroyed manually.

The recommended pesticides are:–

Insecticides for stem borer control

(i) 0.1% a.i. **monocrotophos** eg. **Azodrin** 60 WSC at 17ml in 10 l. water

(ii) 0.1% a.i. **methamidophos** eg. **Tamaron** 50 EC at 20ml in 10 l. water

(iii) 0.1% a.i. **dimethoate** eg. **Rogor** 40 EC at 25ml in 10 l. water

(iv) 0.1% a.i. **trichlorfon** eg. **Dipterex** 95 SP at 11g in 10 l. water

(v) 0.1% a.i. **acephate** eg. **Orthene** 75 SP at 13g in 10 l. water

2) **Stem canker** *(Phytophthora palmivora)*

Stem canker incidence was common. One of the fields checked had 2% incidence. The figure is believed to be higher in the very wet areas and where stem borer, black pod rot and drainage were problematic.

Recommendations

(i) where stem canker is reported, check the field thoroughly at monthly intervals and treat the infections by:–

(a) scraping a superficial layer of the bark to expose the diseased parts. Do not attempt to remove the diseased tissues as this is harmful.

(b) painting the exposed tissues with 0.25% a.i. **metalaxy** eg. Ridomil 25WP at 100g in 10 l water.

It is advisable to add a dye eg. red ochre or any other inert dye to facilitate supervision and checking.

Also it is important to dip the scraping tool into the fungicide mixture before scraping a new plant to minimise spread of the disease. The stem canker may be treated in conjunction with the stem borer control.

Apart from fungicide treatment, the following cultural practices should also be imposed to reduce disease inoculum and minimise injuries which could predispose the plants to stem canker infection:–

(ii) remove all diseased and pest damaged pods from the plant as part of the routine harvesting operations.

(iii) minimise injury to the plant during harvesting, pruning and also ensure adequate control of stem borers.

(iv) improve drainage in low-lying areas.

3) **Emposca plant hopper**

The pest causes severe dieback of terminal shoots and defoliation if not controlled. They are generally more serious in the exposed areas with little shade especially in dry weather. Higher incidence may also occur nearer jungle boundary areas and where *Leucaena glauca* are planted as shade trees.

Recommendations

(i) spray with any one of the systemic insecticides listed below:–

a) 0.1% a.i. **methamidophos**
b) 0.1% a.i. **acephate**
c) 0.1% a.i. **dimethoate**

More than one spraying at 7–10 days is usually required in severe outbreak. Pay special attention to protect the young leaf flushes during peak flushing months. It is useful to add 0.1% **AAR Green Foliar** fertiliser to the spray mixture.

7. Drainage

Poor drainage was common in the low-lying areas on many of the estates visited. This has resulted in very poor growth and planting failures in the water-logged areas. Some areas were also left unplanted because of poor drainage.

Recommendations

Carry out a detailed survey of the drainage on the estate to check the extent of the drainage problem and mark out the problem areas together with the existing drains on a "drainage map". All problem areas should be rectified as soon as possible.

All existing drains should be regularly maintained.

CONCLUSION

Compared to other plantation crops, cocoa is relatively more difficult to grow and manage. The crop is more sensitive to management practices, soil and climatic factors. It also has more than its fair share of pest and disease problems. Many existing problems occurred through bad management previously and unusual bad luck in 1983/84. However, with persistence, enough effort and a dash of good luck, it can be very rewarding to be a **cocoa planter.** It is encouraging to note that one of the estates visited which had a very bad history of planting was able to produce an excellent new planting (still immature) recently. There are now enough good cocoa areas outside the Tawau area to confirm that good cocoa can be maintained outside good volcanic soil areas. It is probably not unrealistic to aim for 1200–1400kg dry beans/ha/year in the Sandakan area now with the current knowledge and management possibilities of the crop.

Ooi, L.H.

Appendix 1.
Recommended VSD tolerant clones for supplying

Clones	% weightage
1st choice	
1) PBC 123 (SC)	10
2) PBC 159 (SC)	10
3) BAL 209 (SC)	10
4) KA 2/101 (SC)	10
	40
2nd choice	
5) PBC 113 (SC)	5
6) PBC 130 (SC)	3
7) PBC 140 (SC)	3
8) PBC 128 (SC)	3
9) PBC 131 (SC)	3
10) PBC 139 (SC)	3
11) SDS 5	2
12) SDS 6	2
13) SDS 20	2
14) SDS 26	2
15) SDS 32	2
16) SDS 52	2
17) SDS 58	2
18) SDS 105	2
19) SDS 3	2
20) SDS 18	2
21) BAL 208	5
22) BAL 204	5
23) K 24/106 (SI)	3
24) K 20 (SI)	2
25) K 21 (SI)	2
26) K 82 (SI)	2
	100

Key: SC = self-compatible
SI = self-incompatible

Manuring schedule 1

Fertiliser recommendations for supplies

Age after Planting (month)	Fertiliser	g/plant
Planting hole after planting	RP Calcium lime (to be broadcasted evenly in 1.5 m radius)	250 500
½	CCM65	50
1½	CCM65	60
1½	RP	250
2½	DAP	50
3½	CCM65	50
4½	CCM65	50
5½	CM65	50
6½	DAP	75
7½	CCM65	75
8½	CCM65	75
9½	CCM65	75
10½	CCM65	75
11½	CCM65	75
	Total	1750
12 1/2	RP	250
12½	CCM65	100
13½	CCM65	100
14½	CCM65	100
15½	CCM65	100
16½	CCM65	100
17½	CCM65	100

A) AAR's Cocoa Breeding and Selection Research Programme*

The main areas which require improvements currently are:–

1) **Yield**
Commercial yields are generally very low compared to the yields obtained in experimental plots. Also, the highest yield obtained in the progeny trials in Malaysia is much lower than the 6.1 tonne per ha. quoted by Corley and 5 mt/ha reported by Tan in Papua New Guinea.
Hence, there is still tremendous scope for yield improvement in Malaysia. There is also a need to develop more adaptable materials with narrower gap between commercial and experimental yields.

2) **Pest and Disease (P&D)**
Vascular Streak Dieback (VSD) and Black Pod Rot are currently the most important diseases in Malaysia particularly in high rainfall areas. Although, some improvements have been made in breeding and selection for more resistant materials, losses to the diseases are still high.

With regard to insect pest, the presence of the Cocoa Pod Borer (CPB) in Sabah has resulted in much higher cost of production and also high crop losses if the pest is not adequately controlled. The other major insect pest is *Helopeltis* which attacks both the cherelles/pods and the young shoots often resulting in high economic losses.

3) **Quality**
Malaysian cocoa bean is currently sold at a discount in the international market because of various complaints on its quality. The main ones are small beans, high shell content, poor flavour and acidity. The last two are rather subjective and are also influenced by processing. Improvement in bean size will normally also result in lower shell content. It is rather unfortunate that a high percentage of the planting materials which are more tolerant to VSD have rather small bean size.

With the above problems in mind the following R&D programmes have been drawn up for implementation in the next 5 years.

1) Germplasm collection, evaluation and exploitation
2) Breeding trials
   a) Inter-origin crosses eg. Trinitario x Amazonian
   b) Crosses between cultivars with complementary characters eg. high bean count x big bean
   c) Upgrading of commercial planting materials eg. bean size improvement in VSD tolerant but small bean size hybrids.
   d) Reciprocal cross testing
3) Clonal trials
   a) Multi-locational (GxE) trial to test clonal adaptability and to enable site specific recommendations.
   b) Buddings vs seedlings trial (to compare performance of common clones and hand-pollinated F1 hybrids)
   c) Scion/rootstock interaction trials
   d) Cutting vs buddings trials
4) Breeding & selection for P&D resistance
   a) VSD resistance programme
   b) *Phytophthora* black pod rot resistance programme
   c) *Phytophthora* stem canker resistance programme
   d) CPB resistance programme
   e) *Helopeltis* resistance programme

Apart from the foregoing, the following miscellaneous projects will also be pursued.

a) A uniformity study to check variation in yield between individuals trees within a progeny.
b) A physiology study to check why some progenies are better than others and also to develop an efficient method of ortet mother tree selection for cloning eg. based on harvest index.
c) A drought resistance study in pot trials.
d) Nursery screening for P&D resistance studies.
e) *In vitro* screening for P&D resistance studies.
f) Sexual compatibility studies.
g) A hand-pollination vs assisted and open-pollination seedling materials study.
h) Comparison of recommended planting materials studies.

B) Cocoa Agronomy Research Programmes

The main R&D program drawn up are aimed at solving the major agronomic problems currently encountered. They are:–

1) Rehabilitation of low productive stand areas mainly areas devastated by VSD. A series of trials on supplying with plants of different plant morphologies, ages and types of planting materials and with different budding techniques, P&D control and nutrition programmes will be implemented shortly in Sabah to determine the best way to rehabilitate such areas. An attempt will also be made to quantify the crop loss due to VSD infection.
2) As manuring is the highest single input, the nutritional requirements of cocoa particularly in Sabah where there is very little information will be accorded due priority.
3) A trial on drip irrigation, shade and fertiliser regimes on the site yield potential of clonal cocoa.

Four short term studies are also proposed to gather some basic data on:

1) effect of P nutrition on root development and growth of cocoa.
2) efficiency of AAR fortified sludge cake compared with CCM 65 as source of fertiliser.
3) nutrient uptake by cocoa seedlings from AAR foliar fertiliser.

and 4) the possibility of using ammonium chloride as source of N for cocoa in view of current price advantage and lack of information.

Ooi L.H.

** Editors' Note: A continuation of write-ups on AAR Research Programmes in Jan' 88 issue.*

COMMODITY NEWS

PALM OIL

1. *Palm oil statistics (Oils & Fats International Issue 2: 1988)*

Production of Selected Oils ('000 Tonnes)

	Total 1986	Total 1987	1988*
Soyabean	14,496	15,423	15,480
Palm	7,685	7,784	8,178
Rapeseed	6,595	7,488	8,012
Sunflowerseed	7,027	7,240	7,496
Cottonseed	3,515	3,225	3,423
Groundnut	3,460	3,391	3,194
Coconut	3,202	2,966	2,718
Palm Kernel	1,028	1,032	1,080
Total	47,009	48,550	49,580

* Twelve months estimated to September 1988

2. Export earning from palm oil by Malaysia for 1987 are estimated to have totalled M$3.13 billion with some 4.05 million tonnes exported. The figures, said local analysts, are based on an average price of M$772 per tonne which may be contrasted with the average price of M$579 per tonne in 1986.
3. The tariff rate on Malaysian palm oil imports into China will be reduced from 20% to 10%. Meanwhile China has become a significant buyer of Malaysian palm oil. Imports rose from less than 10,000 tonnes in 1983, to 14754 tonnes in 1984; then increased sharply to 60,000 tonnes in 1985, 120,000 tonnes in 1986 and 400,000 tonnes in 1987.
4. Indonesia's (1988/89) palm oil output is expected to total 2.12 million tonnes, Agriculture Minister Achmed Affandi told a recent parliamentary hearing.
5. Egyptian authorities have allowed the use of palm stearin in soaps as a tallow substitute as well as in formulation of vegetable ghee and shortening. With this development, palm oil import by Egypt in 1988 will be doubled. In January 1988 alone Egypt imported 32000 tonnes of palm products.
6. The American Soybean Association has been conducting extensive multimedia advertising campaigns on the goodness of soyabean in Portugal, Spain, Italy and U.K., involving newspapers, magazines, posters and TV. The ASA budgeted £5 million for these promotional activities.
7. A recent crop survey by the Americal Farm Bureau Federation estimated that the 1988 corn and soyabean harvests would be down by 40% and 20% respectively as a consequence of the recent severe drought which devastated fields on much of the US Farm Belt. This is the reason for the current high price of palm oil.

RUBBER

Surge In Natural Rubber Price

Buoyed by continuing worldwide demand of rubber which outstripped supply. Natural rubber (NR) price climbed to a high level of $4.00 per kg for RSS 1 at the end of May 1988, which was seen eight years ago. At the time of writing (2/7/88) RSS 1 price remained comfortable at $3.62 per kg, whilst SMR CV/L enjoyed large premium of around $2.00 per kg. Latex concentrate was better still, with report of premium of more than $4.00 per kg (dry) over RSS 1.

Rubber brokers believed the undertone of the market was clearly set when heavy sales from INRO failed to halt the sharp price surge. The 360,000 tonne buffer stock was believed to be almost sold.

What is supporting the high prices? Will the rubber market remain buoyant? These are the questions uppermost in the mind of industry analysts.

Seasonal down-turn of output in the Far East, strong demand for tyres and a boom in the production of surgical gloves and condoms resulting from AIDS scare are reasons frequently cited for the up-trend in price.

The latest bulletin of the London-based International Rubber Study Groum (IRSG) estimates that the overall position of world NR moved into a 70,000 tonne deficit (out of 4.64 million tonne produced) in 1987. As for synthetics, the deficit looks even more critical at 115,000 tonne.

Several forecasts are projecting the bullish trend to continue at least until the end of the year. Suppliers were said to have already committed to as far forward as the first quarter of 1989.

COCOA *Cocoa futures*

The Kuala Lumpur Commodity Exchange (KLCE) has just launched the *cocoa futures contract* on the 8th August 1988.

This means that cocoa processors, producers, dealers and brokers in this part of the world will be able to hedge when the New York and London markets are closed.

The KLCE's cocoa futures contract will provide a pricing mechanism which is expected to be used widely as a benchmark for pricing cocoa in Malaysia and the surrounding region.

The pricing of cocoa is presently based on the closing prices of the London cocoa terminal market, with adjustments for currency, freight, bean count and growth differentials.

OTHER PRODUCT NEWS

Biotechnology Upgraded Oils

Vegetable oils command a world market of over US$35 billion. The bulk of the oils are of low value eg. palm oil, rapeseed oil, soyabean oil and sunflower seed oil. Scientist have begun to tap this vast potential using biotechnological methods to improve the properties and thus the value of oils and fats. The two approaches adopted are the genetic modification of oil-seed plants to induce production of altered oils, involving genetic engineering, *in vitro* mutagenesis (i.e. induction of mutation in tissue culture) and tissue culture techniques; and the enzymatic or microbial modification (i.e. fermention) techniques of the oils and fats themselves.

Rapeseed (canola) will be the forerunner for genetically modified oils because it is easiest to geneticall-y engineer, has the lowest saturated fat content, and the most efficient crop, yielding 40% of its weight in oil. Oil palm being a perennial tree crop, is likely to be the most difficult to genetically engineer.

Enzymatic modification of oils will use the least expensive oils as substrates, giving palm oil an advantageous position. However to be profitable, applications will have to give a value increase of 25–50% over the price of unmodified oils.

70% of the oils and fats are used in edible products. Improvement in this area will include lowering saturated fat levels, lowering caloric value and reducing linolenic acid content. Vegetable oils also have industrial applications such as lubricants, detergents and plastics. The new technology would enable production of high value products eg. esters, high purity monogly cerides, diglycerides, specialty detergents, emulsifiers, specific fats or oils. Tissue culture products are already in the market while enzymatic modification production will appear in the market within the next five years.

Below is a list of companies working on oils and fats modification.

Lubrizol (Ohio) –
Modifying sunflower, rapeseed and corn plants to upgrade oils. Colla-

brates with two biotech companies, Sungene Technologies Corporation and Agrigenetics Corporation, to produce high oleic and high linoleic sunflower varieties through somaclonal variation (variants from tissue culture) techniques.

High oleic acid (monounsaturated) oils are considered beneficial for lowering blood serum cholesterol. These oils will be for food uses such as deep frying, baby food formulations, lotions and creams, and also for industrial uses in lubricants, plastic additives, elmusifiers and chemical derivative intermediates.

Calgene (California) –
Genetic engineering of rapeseed for both edible and industrial oil markets.

Biotechnica International (Canada) –
Genetic manipulation of rapeseed and flax to modify fatty acid composition.

Unilever (UK) –
Tissue culture of oil palm. Studies genetic modification and enzymatic processes. Produces cocoa substitute semi-commercially.

Cetus Corp. (California) –
Has patents for use of enzymes to modify oils and fats.

Genecor Inc. (U.S.A) –
Protein engineering of enzymes for use in modifying oils and fats.

Henkel Research Corp (California) –
Uses genetic engineering to develop microbes for oil and fats modification.

Ajinomoto Co. (Japan) –
Enzymatic conversion of diglyerides to triglycerides or replacement of one fatty acid with another.

Asahi Denka Kogyo (Japan) –
Enzymatic processes to produce cocoa butter substitute from palm oil.

Fuji Oil Co. (Japan) –
Has patent for use of lipase to make cocoa butter.

2. **Robots** have traditionally found work in the industrial sector, but researchers in Florida and France have developed experimental robots designed to pick fruit in orchards. The French apple-picking robot is self-propelled, uses a three-camera vision system to find the fruit and a vacuum gripper to gently plug the apples off the tree. The American picker uses a small colour TV to find oranges. Both fruit-picking robots are several years away from commercial introduction.

How about a robot harvester for the oil palm and robot tappers for rubber? Sure beats having to contend with shortage of and difficult human labour!

3. Cleaning up an oil spill in the sea is a tremendous job. General Technology Applications Inc. of Virginia has produced **"Elastol"** which uses polyisobutylene, a sticky synthetic rubber to transform oil slicks to a cohesive mass to speed recovery.

Boeing, the plane company, has been awarded a contract by the US Air Force to develop tyres for planes that take off and land at 250 to 550 m.p.h.

Will natural rubber have a role in these products?

4. **Biosensors** detect and measure chemicals found in living organisms by translating a chemical signal into an electrical signal. Biosensors have a wide range of uses ranging from food processing to medicine. In medicine, it can be used for emergency diagnosis of drug overdose or poisoning. In food processing it can be used to check for contaminants, illegal substances freshness.

Perhaps a day will come when biosensors can expedite our plant nutrition status diagnosis for fertiliser recommendations.

Soh, A.C.

AAR TECHNICAL PAPERS 1988 (MARCH – JULY 1988)

1. 4/88
An assessment of the usefulness of silt pits as a water conservation measure in mature oil palm areas in the Bahau area — TKC
2. 5/88
Survey of dryness incidence in PB235 and PB 260 — CWH, PK, OTS
3. 6/88
Alternative rock phosphate sources to CIRP — CWH
4. 7/88
Rainguards — CWH
5. Confidential
Feasibility for research into improved oil palm harvesting poles — CPS MMM
6. 8/88
Soil inspection and suitability assessment of Rancangan Penggeli Kecil for oil palm cultivation — KKK
7. 9/88
Report on Local Plant Analysis cross-checks 1986 and 1987 (presented at the 9th Seminar on Standardization of Soil and Plant Analysis 30/3/88) — CKS
8. 10/88
Choice of rubber clones for BEA estate — CWH
9. Confidential
Survey of dryness incidence in BEA estates — CWH
10. 14/88
Corynespora leaf fall disease of Hevea (paper presented at the TPSB/AAR meeting held on 7/6/88) — OTS
11. 11/88
Rainguards — CWH
12. 12/88
Seasonal yield patterns and their effects on the management of cocoa — OLH
13. 13/88
Yield profile of RRIM600 in TPSB estates — OTS
14. 15/88
Choice of oil palm planting materials for different situations — TKC, SAC
15. 16/88
Cocoa yield pattern and effect on work programme on estate — OLH
16. 17/88
Hand-pollinated vs open-pollinated hybrid cocoa seeds — OLH
17. 18/88
Dryness problem in PB235 and PB260 — CWH
18. 19/88
Suggested sources of nutrients for AAR advisory estates 1988/89 — CWH
19. 20/88
Highlights of some agronomic problems in the Sandakan cocoa areas visited in February/March 1988. — OLH, CPS, GKJ
20. Plant Biotech 1988–Technological a... Commercial Applications — SAC

AAR Advisory Circulars

1. 5/88
Pesticide Act 1974, Guidelines for aerial spraying pesticides — MMM
2. 6/88
Cocoa pod borer — CPS
3. 7/88
Cocoa stem canker — OLH
4. 8/88
Spider mite — OLH
5. 9/88
AA foliar fertilisers — CPS

SPECIFIC RECOMMENDATIONS CONTAINED HEREIN SHOULD ONLY BE IMPLEMENTED WITH PROPER AUTHORISATION