AA RESEARCH NEWS

July '93

EDITORIAL

FIELD VISIT TO AAR STATION AT BALAU ESTATE

Apart from providing agronomic advisory and research back-up services for the plantation crops, AAR also produces quality DxP seeds and tissue-cultured oil palms.

How are these planting materials produced at AAR?

The best way to answer the question is to invite the interested parties to see for themselves in the field. A special occasion called FIELD VISIT TO AAR STATION AT BALAU ESTATE has been planned whereby AAR's principals and clients will be invited to visit AAR's oil palm breeding and DxP seed production operations and the latest in oil palm tissue culture.

We have therefore taken this opportunity to devote this issue of AAR News solely to forearm the participants with the relevant information to participate actively during the FIELD VISIT. For readers who are unable to attend, we wish you happy reading and look forward to see you next time.

A comprehensive programme has been drawn up whereby participants will be taken to three STATIONS in three separate groups. STATION 1 will feature OIL PALM TISSUE CULTURE and related issues. DxP SEED PRODUCTION will be held in STATION 2 where all the procedures starting from controlled pollination right down to despatch of germinated seeds will be demonstrated and discussed. At STATION 3, participants will have a chance to examine a field of mature clonal oil palms as well as exhibits of a wide range of oil palm fruits.

While much efforts and thoughts have been put in by the FIELD VISIT organisers to make the visit worthwhile, it is never an easy task to cater for a large number of visitors in the field particularly the problem of logistics. So bear with us for any shortcoming. Feedbacks are most welcome.

HAVE A FRUITFUL FIELD DAY !

OOI, L.H.

HIGHLIGHTS

Field Visit to AAR Station at Balau Estate- Travelling Plan

Group	Stop					
	1	2	3	4	5	6
1	Bus station (arrival)	Station 1 (Lunch)	Station 1 (TC)	Station 2 (SP)	Station 3 (CPT)	Bus Station (depart)
2	Bus station (arrival)	Station 1 (Lunch)	Station 2 (SP)	Station 3 (CPT)	Station 1 (TC)	Bus Station (depart)
3	Bus station (arrival)	Station 1 (Lunch)	Station 3 (CPT)	Station 1 (TC)	Station 2 (SP)	Bus Station (depart)
Time*	1.00 pm	1.00 pm to 2.00 pm	2.00 pm to 3.00 pm	3.00 pm to 4.00 pm	4.00 pm to 5.00 pm	5.00 pm

Day 1: 22nd August 1993 - TPSB

Group	Stop				
	1	2	3	4	5
1	Station 1 (Tea/ Registration)	Station 1 (TC)	Station 2 (SP)	Station 3 (CPT)	Station 1 (Lunch)
2	Station 1 (Tea/ Registration)	Station 2 (SP)	Station 3 (CPT)	Station 1 (TC)	Station 1 (Lunch)
3	Station 1 (Tea/ Registration)	Station 3 (CPT)	Station 1 (TC)	Station 2 (SP)	Station 1 (Lunch)
Time*	8.00 am to 9.00 am	9.00 am to 10.00 am	10.00 am to 11.00 am	11.00 am to 12.00 noon	12.00 noon to 1.00 pm

Day 2: 23rd August 1993 - BEA

Key:

TC	–	Tissue Culture/AAR field office (Station 1)
SP	–	DxP seed production (Station 2)
CPT	–	Clonal/progeny trials (Station 3)
Bus Station	–	OP nursery
*	–	Time alloted includes travelling time

Travelling Time

From	To	Mode/time required
Bus station	Station 1	Walking/2 min.
Station 1	Station 2	Walking/2 min
Station 1	Station 3	Vehicle/5 min.
Station 2	Station 3	Vehicle/5 min.
Station 2	Station 1	Walking/2 min.

STATION 1

PRODUCTION OF OIL PALM CLONES THROUGH TISSUE CULTURE

INTRODUCTION

Oil palm is a monocot with one shoot apex wherein the apical dominance persists throughout its life span. Unlike date palm, oil palm does not produce side shoots or suckers. Neither is it amenable to conventional methods of vegetative propagation such as grafting or layering. Prior to the tissue culture technique, there is no known method of vegetative propagation of oil palm on a commercial scale.

Tissue culture is a labour intensive but a promising method of asexually propagating oil palm for cultivation and breeding purposes. Ever since cellular totipotency, ie. all plant cells have the potential/capability to become complete plants, was experimentally demonstrated, tissue culture has been widely used as a tool in the propagation of plants. The totipotency of oil palm leaves has been proven by Rabechaulte et al. (Oleagineux No. 11,531-534, Nov. 1972) when they produced plantlets from fragments of young leaves cultured in vitro.

AAR TISSUE CULTURE (TC) Lab was set up in mid - 1986 with the objective of producing true to type clonal plantlets for large scale cultivation. In view of the abnormality problem, initial efforts were devoted to defining a growth regulator regime at the embryoid proliferation and germination stage which could promote embryoid proliferation with minimal use of exogenous auxins. Confidence in the existing TC protocol increased when floral census of earlier field plantings of ramets showed the average abnormality rate to be less than 5%. Then in late 1990, the decision was made to increase production of ramets for large scale field evaluation. The basis behind the decision was to gauge the extent the existing TC system could be pushed before problems occur. Also, this approach would provide valuable experience in the organisation and management of a commercial TC lab.

TECHNIQUE

The current protocol for tissue culture of oil palm consists of 5 stages as diagrammed below :-

STAGE - 1	:	CALLUS INDUCTION	LEAF EXPLANT (2 - 6 months)
STAGE - 2	:	CALLUS DIFFERENTIATION	CALLUS (1 - 6 months)
STAGE - 3	:	EMBRYOID PROLIFERATION & GERMINATION	EMBRYOID (6 months) FIRST SHOOT
STAGE - 4	:	SHOOT DEVELOPMENT - ROOT INDUCTION	SHOOT (2 - 4 months)
STAGE - 5	:	ACCLIMATIZATION	PLANTLET (2 - 3 months)
			POLYBAG PLANTING

Stage - 1 : Callus Induction (CI)

The initial explants used are pinnal fragments (1 cm.2) from unemerged leaves of the spear. The spear is usually cut around 15 cm above the growing point in order not to kill the palm. Two to three thousands leaf explants can be obtained from a spear of 45 cm long. The leaf explants are excised under aseptic condition, decontaminated or sterilised before inoculation onto culture media incorporated with auxins to promote callus induction.

The first crop of calluses can be observed around 2 months from inoculation. CI rates usually peak around 4-6 months. Meanwhile, the explants without callus are subcultured/transferred to fresh media every 3 months. After 2-3 subcultures, the non - callusing explants are discarded to make room for new inoculations. The CI rates in the lab averaged 28% of clean explants and 100 % of palms inoculated.

Stage - 2 : Callus Differentiation (CD)

Upon CI, the callusing explants are transferred to media incorporated with auxins to promote differentiation of callus to embryoids or embryogenesis. The first crop of embryoids can be observed around 1-2 months from CI. CD rates usually peak around 4-6 months from CI. Subculture of callus to fresh media is carried out every 2 months for 6 subcultures. The CD rates in the lab averaged 12 % of total calluses and 87 % of palms inoculated.

Occassionally, CD will take place simultaneously with CI. Formation of embryoids has also been observed in the absence of callus, ie. the embryoids arise directly from the explants. The direct embryogenesis rates in the lab averaged 22 % of total embryoids and 49 % of palms inoculated.

Stage - 3 : Embryoid Proliferation and Germination (EPG)

The embryoids are separated from the calluses before the former are subcultured to media incorporated with auxins at reduced concentrations for EPG. The remaining calluses are transferred to same CD treatment for another round of embryogenesis.

The embryoids are subcultured every 2 - 3 months for 18 subcultures or up to 5000 shoots produced per embryoid line, whichever comes first. In the tissue culture of orchid, a 5% abnormality rate can be expected within the first 5000 shoots produced from one axillary bud.

Rates of EPG can be partly controlled by the concentrations of exogenous auxins used. Generally, higher concentrations tend to promote embryoid proliferation, while lower concentrations favour embryoid germination into shoots. Adhering to the growth regulator regime at AAR, whereby the exogenous auxin levels are gradually reduced with every 2 subcultures, the following observations have been made :-

1) Embryoid proliferation (EP):

At subcultures 1-4, the average increase in embryoid mass per subculture is 2-3 times the preceding mass; at subcultures 5-8, the increase is 1-1.5 times: and at subsequent subcultures, the proliferation rates plateau around one.

2) Embryoid germination(EG)

Embryoid germination into shoots starts at subcultures 3-4 with 5-10% of the embryoid mass sprouting shoots. Percentage of embryoid mass forming shoots increases with increase in subculture number; by subculture 8 onwards, 40-60 % of the embryoid mass are with shoots.

The current objective is to obtain a ratio of 1:1 of embryoid proliferation to germination in order to ensure continuity in shoot production. Besides concentrations of exogenous growth regulators, ratio of EP : EG can be manipulated to a certain extent by the following factors :-

1) Types of culture vessel enclosure, eg.:

a) Aluminium foil favours embryoid proliferation

b) Cotton wool promotes both proliferation and germination

2) Types and concentrations of media substrate, eg.:

a) EPG rates are better on gelled media than liquid

b) EG rates are higher on media gelled with gelrite (from gellan gum) than on agar (from sea-weeds) media.

3) Subculture frequency, eg.:

Embryoid mass subcultured at 3-4 months intervals are more shooty than those subcultured at 1-2 months intervals.

Stage - 4 Shoot Development (SD) - Root Induction (RI)

Once the shoots are 3 cm. in height, they are excised to SD media in the absence of growth regulators. After 2 -3 months, 90 % of the shoots are sufficiently tall (> 6 cm.) for RI in the presence of an auxin. Following this procedure, RI rates were inconsistent and ranged between 30 - 80 % after 2 - 6 months in culture.

A new procedure is currently being evaluated wherein shoots (< 3cm. height) upon germination are transferred to a modified treatment for both RI & SD. After 2 months in culture, 80 % of the shoots have rooted and 60 % have attained a height of 8 cm. and therefore can be transferred to the conditioning chamber.

Using the RI - SD approach, the expected reduction in labour and chemical costs are estimated to be 50 %. Also, culture room space will be more efficiently utilised when plantlets can be sent to the conditioning chambers within 2 - 3 months instead of 4 - 9 months.

Stage - 5 : Acclimatization or Conditioning of Plantlets.

Plantlets (shoots with roots) of ≥ 8 cm. in height are transferred to sand-bed in the conditioning chamber and remain there for 2 - 3 months. During this period, the plantlets are gradually weaned from the in vitro condition of 100 % RH. The adaptation of plantlets to the ambient conditions is effected by exposing the plantlets for 2 weeks to high humidity in plastic chambers equipped with a misting system; the RH is then gradually reduced by rolling up the sides of the plastic chamber periodically. By end of 4 weeks from transplanting, the plastic covering will be completely removed.

The general maintenance in the conditioning chambers consists of :-

1) Foliar fertilizer application at 2 times/ week after 4 weeks from transplanting.

2) Pest control measures against snails, mole crickets, spider mites and leaf-eating caterpillers.

After conditioning, the plantlets are despatched as bare-root seedlings to the estates. Survival rates in the conditioning chambers are around 95 % of which about 80 % can be sent to the estates. The remaining 15 % consists of stunted plants and plants with "self-pruning" characteristics. These are discarded and set aside for observation respectively.

CONCLUSION

Between August, 1991 to June, 1993, more than 116,000 conditioned bare-root ramets have been sent to 11 estates for field evaluation of clonal performance and lab protocols for clonal fidelity. Of the 10,302 ramets (74.7 ha.) that have been field planted in 1991, 6257 were at the fruiting stage during the recent floral census for abnormality; 69 ramets (1.1%) were found to have mantled fruits.

Todate, the cause of TC palms producing mantled fruits is still uncertain. In the TC of other crop plants, the incidence of abnormality may be attributed to the use of exogenous growth regulators, the presence of a callus phase and the number of subcultures.

WONG, G.

CLONAL OIL PALM NURSERY PRACTICES.

INTRODUCTION.

Oil palm clonal materials were sent out on a semi-commercial scale to participating estates from 1990 onwards and intensified from 1992. In 1993, an estimated 81,500 ramets will be sent to 12 estates.

This write-up serves as a guideline to estates receiving tissue culture ramets. Most of the crucial work mentioned would be done by AAR personnel. This includes culling, distribution for field planting and field point maps.

CONDITIONING NURSERY.

Prior to despatch to the estate nursery, the ramets have undergone a period of conditioning of about 2 months at the tissue culture conditioning nursery at AAR. During the ramets' growth and development in the laboratory, they were under 100% humidity and artificial lighting. Thus the conditioning period is necessery to acclimatise them gradually to ambient conditions. On transferring to the conditioning nursery, they are initially maintained at high humidity, under clear PVC covers. An automatic misting system is employed to periodically mist the nursery to maintain the humidity and keep the temperature under 30°C. After 2 weeks under high humidity, the PVC covers are slightly raised to reduce the humidity for another 2 weeks before the cover are removed totally. At this stage the ramets are fully conditioned.

The ramets are kept in the nursery for a further 4 weeks to develop to about 2 to 3-leaf stage. During this 4 weeks period, foliar fertlizers are applied twice weekly.

The ramets are despatched to estates as 2 - 3 leaves bare-root plantlets. The plantlets are put into clear polybags in variable numbers. The polybags are then packed into seed despatch paper cartons for sending off to the estates.

The ramets are despatched as clones packaged together. Each plantlet will bear a field code (e.g. 33124), a clone number (e.g. S172 or A23) and a cross number (e.g. T1 or 208). The estate is requested to maintain the identity of each ramet right through till after field planting. Prelabelled plastic tags for each ramet are provided for this purpose.

Maintenance of the ramet's identity allows AAR to relate the field performance of each clonal plant to its culturing (laboratory) history.

ESTATE NURSERY.

a) Planting

The ramets should be planted straight - away upon consignment receipt. Boxes of ramets not being planted yet should be kept in a shaded area. If there is a delay in planting of one day, the boxes should be kept overnight in a non air-conditioned room.

The ramets can be planted into a prenursery first or direct to a single stage nursery (close - spaced initially). Shading of 50% or more should be provided in both cases until the transplanting shock is overcome. (approx. 2-3 weeks).

A prenursery shed should have a shading of 50 % and oil palm fronds are acceptable Sides of the shed should also be shaded to keep out direct sunlight where necessary. Each bed of 45 ft x 3 $^{1}/_{2}$ ft should be able to house 100 rows of 10 polybags per row (6" X 9"). A 2 ft passage between beds should be provided for ease of maintenance.

The bags should preferably be filled with a sandy -loam soil premixed with 15g Jordanian rock phosphate (100g for large bags). When planting, a 4cm hole can be made in the soil with a wooden stake and deep enough to accommodate the roots. Put the roots gently into the hole and cover up with soil firmly up to the collar of the ramet. Deep planting must be avoided. Water until soil is completely soaked and check that drainage is satisfactory.

Stick the labelled plastic tag into the soil next to the inside of the bag and staple the tag to the bag for added security.

Planting should be done in sequence as per list enclosed with the despatch.

AAR staff will be present to demonstrate and assist for the first consignment.

b) Watering.

Watering should be done immediately after planting and thereafter twice daily. Ramets should be watered until water is draining from the base of the bags.

c) Manuring.

Foliar manuring programme can begin once the ramets are harder, i.e. approximately 2 to 3 weeks after planting as per AAR Advisory circular No. 8/89/CPS titled "Manuring Programme For Oil Palm Nurseries". Fertilizer rates should follow that for 3-month old seedlings in the circular.

d) Culling.

In the prenursery stage, before transplanting (at about 2 $^{1}/_{2}$ - 3 months old) to large polybags, a round of culling should be made. Please inform AAR of culling date in advance so that AAR staff can be present to undertake the culling and recording. The usual "seedling type" runts may be encountered namely :

i) Stunted ramets (no or small new leaves, die-back of new leaves)

ii) Grassy ramets.

iii) Rolled leaved ramets

vi) Diseased ramets.

One disorder peculiar to ramets is known as " self - pruning " whereby some of the leaves are missing with jagged edges remaining, may also be encountered. Such ramets can recover under proper manuring and can be left in the prenursery until remission in about 2 months time before transferring to large bags.

In double - stage nurseries, the main nursery practices are as per AAR Circular No 8/89. Where possible, the ramets should be planted as clonal blocks to facilitate distribution during field planting. The plastic tags from the prenursery should be transferred to the big bags and similarly stapled to the respective bags.

The age at planting out to the field is as per normal recommended practice.

The following runts may be encountered at this stage and should be culled prior to field planting :

i) Stunted ramets

ii) Erect ramets

iii) Severely twisted ramets - more peculiar to ramets

iv) Acutely diseased (eg: Curvularia, Helminthosporium) or deformed (eg. boron deficiency) ramets.

Order for 165 ramets per hectare to allow for approximately 20% culling.

Once again, AAR should be given advance notice of culling dates in order for its staff to be present to assist in the culling and recording.

e) Field planting.

This final stage would require close supervision to ensure that there are no mix - ups of the clones at planting. As such AAR staff will liaise with the estate as to the planting dates and will be present throughout the planting to supervise the distribution of the ramets in the field.

Before field planting the identity of each ramet will be labelled on the youngest suitable frond rachis (label includes field code, clone no. and cross no.). A white paint marker pen (Artline 440 or Uni 444) is most suitable for this purpose. The precise number of plantable ramets per clone availab is required to plan out the field planting and to prepare a point map for guidance during the field distribution. The ramets should be planted out in clonal blocks. AAR staff would prepare the point map. The estate should put in the drainage and road requirements prior to lining in order to facilitate the point map preparation.

A copy of the map would be forwarded to the estate upon completion of the field planting.

f) Supplying.

Should any supplying or additional points be put in after the planting, the estate should endeavour to use ramets of similar clones a the surrounding ramets in the supply or additional point area. The supplies'/additions' identities should be entered in the point map and AAR informed of the changes.

g) Field practices.

All field practices are as per normal immature oil palms. The only exception is that the estate should not disbud the clonal palms and should inform AAR once flowering of the ramets have started.

AAR staff would then visit the estate to census and evaluate the ramets.

TAN, C.C.

STATION 2

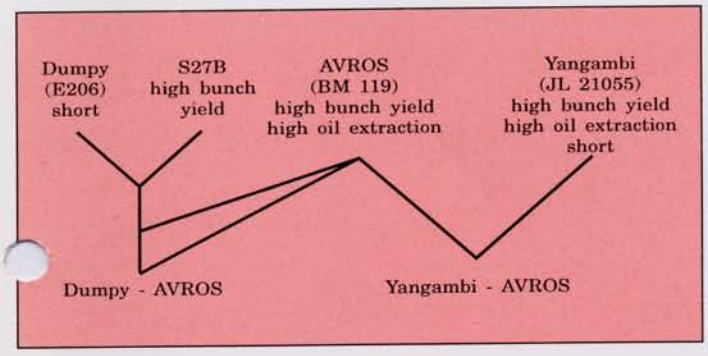
PRODUCTION OF AA DXP SEEDS

- SIRIM & PORLA Licensed Seed

AA DXP seeds and seedlings are licensed by SIRIM and PORLA.

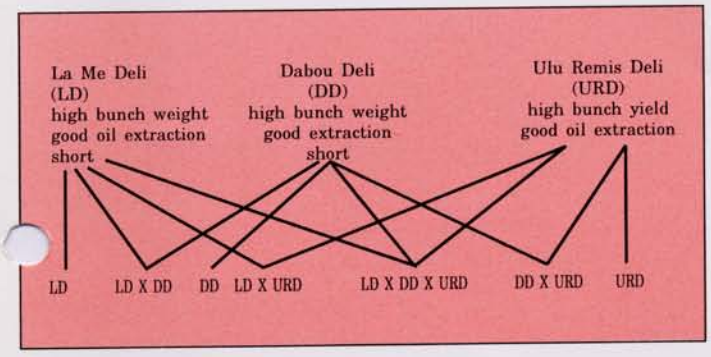
- Superior Pedigreed Seeds.

AA DXP seeds are produced from selected dura and pisifera parents derived from superior pedigrees which are featured in the best DXP seeds produced locally and internationally.



AA DXP's Pisifera Lineage

AA DXP pisifera parents inherit the high bunch yield characteristic of S27B, AVROS and Yangambi, the high oil extraction of AVROS and Yangambi and the short stature of the Dumpy and the Yangambi parents.



AA DXP's Dura Lineage

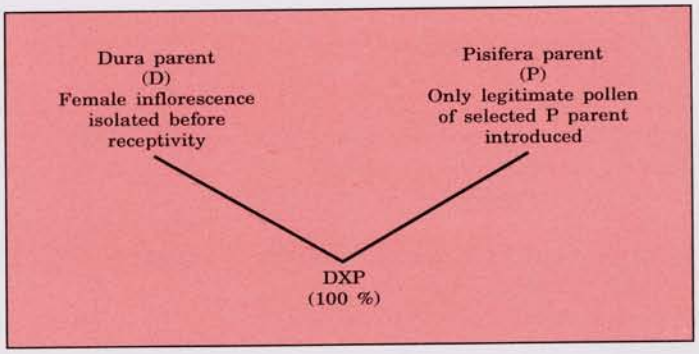
Ulu Remis Deli duras are known for their uniformhigh yield and good oil extraction characteristics.

La Me and Dabou Deli duras have been selected for high bunch weight, good oil extraction and short stature.

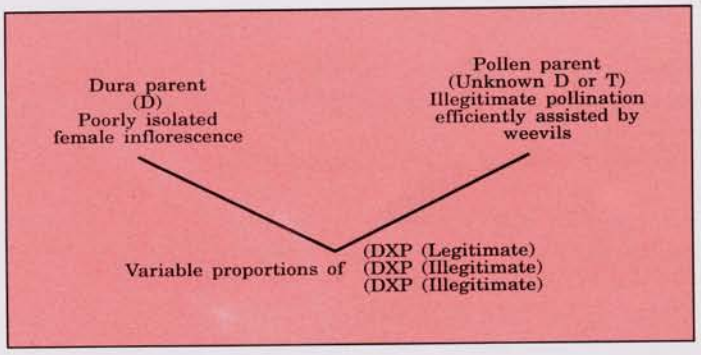
AA DXP seeds combine the best attributes of these pedigrees giving rise to palms with high precocious bunch yields of high oil extraction and a small stature, important attributes in our increasingly scarce and costly labour market.

- High Quality Legitimate Seeds

Strict controlled pollination and seed processing procedures are constantly practised to ensure that every seed produced is legitimate (of known pedigree or parents) and of uniform high quality.



Sloppy controlled pollination procedures result in contamination with illegitimate dura and illegitimate tenera progenies, giving rise to lower bunch yields and oil extraction.



Poor pedigreed seed handling can also result in mixing with open pollinated (illegitimate) seeds.

CONTROLLED POLLINATION PROCEDURES

Collection, Processing, Storage and Handling of Pisifera Pollen

Process.

Isolation of male inflorescence 7-10 days before anthesis.
Harvesting of inflorescence at anthesis.
Preliminary drying, extraction and sieving of pollen
Further drying of pollen in oven/dessicator and freeze-drier for long term storage.
Storage in freezer.
Dispensing of pollen for pollination.

- Control Checks

Isolated inflorescence with tears or weevil presence inside are discarded.
All pollen transfers are made in isolated chambers.
All work surfaces and utensils are sterilized by heat or chemical sterilant before and after each use.
All pollen collections are properly labelled.
Viability testing of pollen, before and after storage. Pollen with viability of > 60 % are used for pollination.

PREPARATION, STORAGE AND GERMINATION OF OIL PALM SEEDS.

- Preparation & Storage. Procedure

Harvested pollinated bunches are chopped, retted and fruits detached.
Fruits are depericarped to give the seeds.
Seeds are further cleaned, washed, fungicide treated and then air dried.
Seed selection-small and abnormal seeds discarded.
Embryo-status (quality) and moisture content of seeds determined
Seeds (adjusted to 19% moisture) stored in cold room or sent for germination.

- Control checks.

Seeds of each pollinated bunch are handled separately till germination and sales despatch.
Any seeds of dubious origin are discarded.
Bunches with high percentage of poor quality seeds (from embryo-status test) are removed from production.
Seeds should not be store for >4 months. Stored seeds with signs of fungal infection are disinfected or removed from production.

- Germination Procedure

Heat treatment (38 - 39°C) of stored seeds (19% moisture for 50 days)
Soaking heat-treated seeds to raise to 22% moisture.
Seed germination at ambient temperature in flushes after 2 weeks incubation.
Selection of germinated seeds for sales despatch.

- Control checks.

Seeds selected for sale are mainly taken from the early flushes.
Seeds selected for sale should have strong well differentiated plumule and radicle of <1 cm length.
Seeds with deformed, weak, diseased or long plumule and radicles are discarded.

HISTORY OF ILLEGITIMATE CONTAMINATION OF COMMERCIAL DXP SEEDS

Period	Status
1960 - 1981	Illegitimacy minimal (< 1-2 %) generally. Illegitimate pollination effected by weak pollinating agents i.e. wind, thrips. Less stringent controlled pollination controls needed: no netting used, gunny-string bag fastening, less discarding of suspect pollinated inflorencences, less intensive supervision of pollination gang.
1982 - 1990	Serious contamination of commercial DXP seeds due to illegitimate pollination (5-40%)brought about by the introduction of a strong pollinating agent, the weevil. Previous controlled pollination procedures inadequate.
1991 -	Post-1990 field plantings are expected to be less contaminated (< 5 %). Serious illegitimate pollination phenomenon discovered in mid 1988. Stringent control measures started in late1988- early 1989. Resultant field planting of which began in late 1990 - early 1991.

Table 1:

A Sample of the Survey Results on Illegitimate Dura Contamination in Commercial DXP Plantings over the Various Periods.

Period	Remarks	Dura Contamination Level (%)	Examples Estate/group	Plant Planting	Dura Materials	Contamination
<1982	Pre-weevil	0-5%	Sg. Mai (I&P)	1966	?	4.4
			Sg. Mai (I&P)	1974	?	3.4
			Sg. Ular (I&P)	1974	?	0
1983-1990	Post-weevil	0.2-45%	Balau (BEA)	1983	HRU	0.4
			Segaria (BEA)	1984	HRU	11.8
			Segaria (BEA)	1983	CH	11.7
			Hing Lee (BEA)	1986	HRU	5-8%
			TRP (BEA)	1986	HRU	19.5
			Sg. Jernih (TPSB)	1987	CH	45.0
			B. Jelai (TPSB)	1986	CH	45.0
			Escot (TPSB)	1987	CH	16.5
			Asahi (BEA)	1989	G Hope	10.0
			See-Sun (TPSB)	1989	AAR	5.0
					HRU	6.0
			Tua Mee (TPSB)	1989	AAR	0.2
					HRU	14.4
			Coalfields (TPSB)	1989	AAR	9.5
>1990/1991	Post-weevil. Materials produced from more stringent controlled pollination	0-6%	BMR (BEA)	1990	AAR	1.0
			Connemara (BEA)	1990	AAR	3.6
			T. Sengat (BEA)	1990	AAR	6.2
			Coalfields (TPSB)	1990	AAR	1.9-2.7
			Tuan Mee (TPSB)	1990	AAR	4.0
			Paloh (TPSB)	1990	AAR	1.2
			A. Hitam (TPSB)	1991	AAR	0.1-1.3

SOH, A.C.

STATION 3

OIL PALM BREEDING.

- Need To Improve Materials

Although AAR is now producing commercial DXP materials which are comparable to the best if not the best in the market, there is always a need to further genetically improve the materials to meet not only current needs i.e. high bunch yield, good oil extraction, low height for ease of harvesting but also future needs eg. good oil quality and specialty oils (high vitamin E and carotene (vitamin A) content and high unsaturation for dietary needs and uses, high stearic acid content for production of cocoa butter substitute and pest , disease and abiotic stress tolerance, to ensure good performance in less favourable enviroments.

To be able to make such genetic improvement one must have genetic variability for these traits.i.e. palms which have these genes (genotypes). Hence one must first assemble the genotypes available as these genes are unlikely to be present in the current highly selected breeding populations. However, many of these genotypes may not have the genes for high yield and the desirable traits of current materials. A breeding programme is thus necessary to mix up the genes so that combinations of the future and current desirable traits can be progressively selected and improved.

A comprehensive breeding plan has also to be drawn up to continuously, efficiently and systemically improve

the populations. Consequently production of improved commercial seeds and/or clonal palms (ramets) can be exploited from them.

.Genetic Base.

AAR has assembled a large genetic base comprising advanced breeding materials from the breeding programmes of many major research groups, which can be readily exploited into commercial planting materials as well as semi-wild accessions for long term breeding improvement.

Dura Base Populations

Felda	-	La Me, Dabou duras via IRHO (Ivory Coast). UR and Dumpy duras.
IOI	-	UR duras
PORIM	-	Nigerian accessions.

Tenera/Pisifera Base Populations

Felda	-	La Me, Yangambi, NIFOR teneras via IRHO (Ivory Coast)
Sabah Dept of Agric.	-	Cameroon, & NIFOR teneras via Unilever
IOI	-	Binga, NIFOR teneras via Unilever
PORIM	-	Nigerian, Cameroon and Zaire accessions.

Breeding Programme and Plan.

AAR has drawn up a comprehensive breeding programme and plan, (Figure 1) which will allow continuous production of improved materials as conventional DXP seeds, clonal seeds, recreated cross seedling (from best cross) clones or ortet clones (from best palms)

Dura Improvement Programme	-	46 ha planted.
Pisifera Improvement Programme	-	50 ha planted
Progeny - Test Programme	-	19 ha planted.
Clonal Testing Programme	-	100 ha
	Total	215 ha.

A sample of the trial results and exhibits to demonstrate the potential of the prospective commercial materials are given.

Tables : 2,3.	Superior dura populations.
4,5,6.	Superior pisifera/tenera populations.
7.	Superior DXT populations & ortets.
8,9,10.	Clonal trial results.

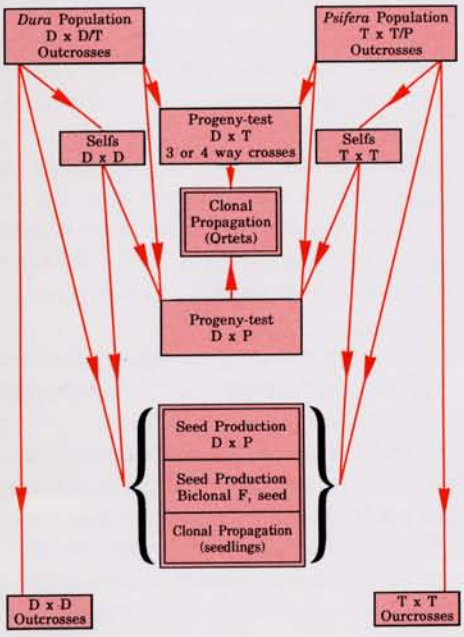


Fig. 1: Outline of AAR's Oil Palm Breeding Scheme

Table 2:

Trial BDI. 86: FFB and Bunch Analysis Results (1989-1992) of Promising Progenies

Prog. No.	Type	Cross	Parental Origins	FFB k/p/a	O/B %	M/F %	S/F %	K/F %
0039	DxD	0105/5 x CEB 6	UR x Dabou	124.3	23.0	69.5	23.6	6.9
0040	DxD	0105/5 x CN 54	UR x Dabou	127.9	21.8	65.2	26.3	8.6
0041	DxD	0105/5 x CDH 28	UR x (Dabou x La Me)	112.4	24.2	69.3	24.1	6.6
0042	DxD	0105/5 x CEF 2	UR x La Me	131.8	22.7	64.8	27.5	7.7
0045	DxD	CEF28 x CDH 42	La Me x Dabou	86.3	23.1	67.6	24.6	7.8
0047	DxD	CDH51 x CEF 24	Dabou x La Me	94.7	22.3	65.7	25.7	8.6
0051	DxP	0251/8 x 0127/37 (DxP Control)	UR x Dumpy Avros	127.6	26.0	83.1	8.5	8.4
Trial Mean	DxP			111.9	22.3	66.1	26.0	7.9

NB. FFB = Bunch yield, O/B = oil to bunch, M/F = mesocarp to fruit, S/F = shell to fruit, K/F = Kernel to fruit.

Table 3:

Trial BD2.86 FFB and Bunch Analysis Results (1989 - 1992) of Promising Progenies.

Prog. No.	Type	Cross	Parental Origins	FFB k/p/a	O/B %	M/F %	S/F %	K/F %
0001	DxD	104/10(self)	UR x UR	87.5	21.4	65.3	26.6	8.2
0004	DxD	250/9 x 0254/62	UR x UR x DY	67.6	20.4	68.8	24.6	6.7
0016	DxD	0106/10(self)	UR x UR	88.9	22.0	64.5	27.0	8.5
0017	DxD	0105/48 x 0261/14	UR x UR	82.4	19.8	69.8	24.3	5.9
0018	DxD	0105/5(SELF)	UR x UR	65.7	20.0	66..2	26.5	7.3
0019	DxD	0254/62 x CDH51	UR x La Me	56.4	20.1	69.4	23.1	7.5
0021	DxD	0254/62 x CEF49	UR x Dabou x La Me	66.2	22.8	70.2	23.3	6.5
0022	DxD	CDN x CDH42	Dabou x La Me	49.6	20.6	64.4	27.1	8.5
0025	DxP	0251/8 x 0282/18 (DxP Control)	UR x Avros	89.5	25.1	82.2	7.8	7.8
Trial Mean	DxD			74.9	19.3	63.4	28.1	8.5

Table 4:

Trial BP1.86 and Bunch Analysis Results (1989-1992) of Promising Progenies.

Prog. No.	Type	Cross	Parental Origins	FFB k/p/a	O/B %	M/F %	S/F %	K/F %
0053	TxT	0127/13 x 01227/30	Dy. Avros x Dy. Avros	79.4	28.8	86.82	6.8	6.4
0057	TxT	CIA61 x CHR43	NIFOR x NIFOR	103.9	27.9	84.5	8.5	7.0
0061	TxT	407/16 self	Cameroon x Cameroon	111.1	29.0	83.8	9.3	6.9
0064	DxP	0251/8 x 0127/37	UR x Dy. Avros	116.6	26.5	82.0	9.2	8.8
Trial Mean				87.9	27.2	83.5	8.5	8.0

N.B. Bunch analysis results on tenera palms only.

Table 5:

Trial BP2.87 FFB and Bunch Analysis Results (1990-1992) of Promising Progenies.

Prog. No.	Type	Cross	Parental Origins	FFB k/p/a	O/B %	M/F %	S/F %	K/F %
0145	TxT	CH0280 x CHR43	NIFOR x NIFOR	46.7	28.8	85.8	4.8	9.5
0148	TxT	0283/55 x 0127/13	Avros x Dy. Avros	24.5	28.4	87.3	5,4	7.3
0149	TxT	0281/55 x 502/22	Avros x Cameroon	37.1	28.6	82.8	9.8	7.4
0150	TxT	0127/30 x BAP15	Dy. Avros x La Me	35.7	27.6	83.7	8.0	8.22
0153	DxP	0251/8 x 0208/18 (DxP Control)	UR x Dy. Avros	58.0	24.5	84.5	8.3	7.3
Trial Mean				34.8	24.9	83.8	8.0	8.2

N.B. Bunch analysis results on tenera palms only.

Table 6:

Trial BP3.89 FFB and Bunch Analysis Results (1989-1992) of Promising prgenies

Prog. No.	Type	Cross	Parental Origins	FFB k/p/a	O/B %	M/F %	S/F %	K/F %
0154	TxT	CKM x 469/10	Avros x Dy. Avros EWS	32.1	26.6	81.2	9.2	9.6
0157	TxT	0127/30 x BAP 15	Dy. Avros x La Me	27.4	26.8	82.1	8.4	9.5
0158	TxT	0127/30 x 0126/37	Dy. Avros x Ybi-Avros	N.A	31.1	84.5	7.9	7.6
0160	DxP	0251/8 x 280/18 DxP (Control)	UR x Avros	N.A	26.3	82.1	8.8	9.1
Trial Mean				26.0	24.9	80.0	10.1	9.9

N.B. Bunch analysis results on tenera palms only.

Table 7:

Trial BT2.87 FFB and Bunch Analysis Results (1990-1992) of Promising progenies)

Prog. No.	Type	Cross	Parental Origins	FFB k/p/a	O/B %	M/F %	S/F %	K/F %
0078	DxT	0254/62 x 0126/11	UR.DY x Ybi. Avros	74.7	27.3	86.4	6.6	6.9
0082	DxT	0106/10 x EWS65/4	UR x NIFOR	97.5	25.3	85.2	7.5	7.3
0089	DxT	0106/10 x 0126/11	UR.DY x Ybi. Avros	84.2	28.5	85.8	6.4	7.9
0091	DxT	37/20 x 0126/11	UR x Ybi. Avros	70.3	27.1	84.2	7.1	8.7
0097	DxP	0104/5 x 0127/4	UR x DY. Avros	61.8	27.1	82.6	9.0	8.4
0094	DxP	0251/8 x 0280/18 DxP (Control)		101.4	25.3	84.6	8.2	7.3
Trial Mean				75.6	24.8	83.0	8.9	8.1

N.B. Bunch analysis results on tenera palms only.

Table 8:

Trial BCT1.86.FFB and Bunch Analysis Results (1989-1992)

Treatment No.	Clone	Source	FFB kg/p/a	O/B %	M/F %	S/F %	K/F %
027	S45	Seedling	148.0	25.5	79.1	11.1	9.8
028	S42	Seedling	141.7	27.9	84.1	7.7	8.2
0.29	S36	Seedling	194.1	28.1	79.7	11.5	8.9
030	0251/8 x 0280/18 (DXP Control)	DxP	175.0	25.3	84.22	8.3	7.4
Trial Mean			162.8	26.1	82.0	9.6	8.4

Table 9:

Trial BCT2.86.FFB and Bunch Analysis Results (1989-1992)

Treatment No.	Clone	Source	FFB kg/p/a	O/B %	M/F %	S/F %	K/F %
033	P12	Seedling	94.2	28.2	83.5	8.4	8.1
034	P10	Seedling	99.3	21.9	78.2	11.8	9.9
035	P8	Seedling	38.8	25.6	77.1	16.3	6.7
036	S42	Seedling	93.0	27.3	83.4	9.2	7.4
037	208	Ortet	95.1	26.8	79.7	10.8	9.5
038	0251/8 x 0280/18 (DxP Control)		103.5	24.6	81.1	9.6	8.6
Trial Mean			91.6	25.9	81.7	9.6	8.6

Table 10:

Trial BCT4-89 FFB and Bunch Analysis Results (Jul-Dec '92)

Clone	Source	FFB kg/p/a	O/B %	M/F %	S/F %	K/F %	Ortet O/B
1	Ortet	27.9	28.6	8.15	10.1	8.4	26.5
2	Ortet	20.9	26.8	79.5	11.2	9.3	27.9
3	Ortet	8.8	27.9	87.8	6.7	5.5	28.4
5/15	Ortet	20.0	28.4	80.4	11.4	8.2)	
5/17	Ortet	20.4	26.2	79.5	12.1	8.4)	28.0
5/14C	Ortet	27.4	30.4	81.6	8.8	9.6)	
6	Ortet	26.9	32.3	84.0	7.8	8.2	34.2
7	Ortet	14.9	28.1	86.4	6.3	7.3	32.1
9	Ortet	21.2	26.2	78.8	12.4	8.8	32.3
10	Ortet	20.0	31.9	81.5	9.7	8.8	31.6
11	Ortet	25.9	30.2	83.9	8.0	9.1	30.7
12	Ortet	16.9	27.2	77.4	11.9	10.7	33.5
RX clones	Selected Seedlings	17.1	24.8	80.5	10.3	9.2	27.3
AAR Std. Cross (DxP)		12.7	21.3	80.1	10.1	9.9	
PORIM Std. Cross		17.6	23.0	81.4	9.3	9.4	
AAR Comm. DxP		17.4	22.8	78.8	11.1	10.1	
GH. Comm. DxP		26.2	25.5	78.2	11.7	10.3	
Trial Mean		20.1	28.3	81.7	9.5	8.7	

SOH, A.C.

ABNORMALITIES IN CLONAL OIL PALMS

INTRODUCTION.

Abnormalities in clonal oil palms were first brought to public attention in March, 1986. These abnormalities manifested themselves in the inflorescences and fruits of the clonal palms. The vegetative parts of the affected palms were normally developed.

Studies are still underway to investigate the possible causes of the abnormalities and the answers are still wanting. Currently it is suspected that the excessive use of certain growth regulators in the culturing media and/or the length of time in culture could be possibly linked to the abnormalities. The abnormalities appeared to be somaclonal as they are found to be heritable.

In AAR, the first clonal trials were planted in 1986 at Balau Estate. These were essentially clones produced at HRU. Todate, the total number of clonal trials planted is 9, covering an area of 83 ha and consisting of over 100 clones.

TYPES OF ABNORMALITIES.

The clonal abnormalities as mentioned, occur essentially in the reproductive organs of the ramets. Such abnormalities can possibly be observed right from the first inflorescences produced by the palms. Estates where clones are planted are usually requested not to disbud clonal palms as AAR need to assess the abnormality status of the palms. This will give an earlier indication of the occurrence of abnormal palms in the clonal planting.

To understand the abnormalities found in tissue culture palms, the early flowering cycle of the palms need to be understood first.

The early flowering cycles of both ramets and palms of seedling origins are the same and basically in the following order.

i) Male inflorescence cycle.
ii) Transitional inflorescence cycle.
ii) Female inflorescence cycle.

The male and female inflorescence cycles are self explanatory. The transitional inflorescence is essentially a female inflorescence with some male spikelets. It can also be termed as a hermaphrodite inflorescence. The male and female flowers in such inflorescences are viable and will form pollen and receptive ovules respectively.

Abnormalities in clonal palms can occur in all the 3 cycles.

i) Male inflorescence cycle.

The main abnormality here is the production of androgynous male flowers. This means that the male flowers have become feminised. Such feminised flowers can range in number from 1 flower to the whole male inflorescence being androgynous.

This androgynous phenomenon occurs both in ramets and in seedling originated materials. The only differences are that the androgyny persists longer in ramets and the severity is also higher in the ramets.

In non-mantled ramets and seedling originated palms, the androgynous male flowers have 1 to 3 carpels and if they become fruitlets, the fruitlets will be parthenocarpic, having 1 to 3 of the fleshy carpels. However the single carpel fruitlet prevails.

Mantled palms, depending on the severity of the mantling, usually have androgynous male flowers with more than 3 carpels, sometimes up to 9 carpels. When these form fruitlets, they will be mantled, with finger-like projections.

Androgynous male flowers may be an early indication as to whether the palm is normal or mantled. However, mantled palms can produce normal male inflorescences or ' normal' androgynous male inflorescence during the first male inflorescence cycle.

ii) Transitional inflorescence cycle.

The transitional cycle also occurs in both ramets and seedling originated palms with no difference between the two planting materials as to the duration and severity of the occurence.

Mantle ramets will usually show up at this stage with the production of mantled fruits (with 4 to 9 fleshy carpels).

iii) Female inflorescence cycle.

When the clonal palm gets into the female inflorescence cycle, confirmation of whether the palm is normal or mantled as well as the severity of the mantling can be made.

The mantled fruits can be parthenocarpic as well as fertile (ie with a viable seed). In severely mantled bunches with almost 100% mantled parthenocarpic fruits, the whole bunch will normally abort. Such mantled palms are usually sterile.

Examples of all the above types of inflorescences and abnormalities will be made available for examination during the field day.

TAN,C.C.