AA RESEARCH NEWS

October'92

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EDITORIAL

Commercial Activities at A A R

In the October 1988 issue of AAR News under the Edito rial, "Spin-offs from R&D" some of the prospective com mercial activities which AAR was developing or embarking on were alluded to. This issue of the newsletter focuses on AAR's commercial activities, some of which have become main stream activities, deriving respectable income and contributing to AAR's development as a leading and innovative commercial plantation research company.

AAR's foliar fertiliser formulations are in great demand and are marketed by three major fertilizer companies under different brand names. Similarly its laboratory, advisory and tissue-culture services are much sought after by outside clients but because of limited facilities and the need to serve our own estates first, it has to turn away many potential clients. AAR's warfarin-based rat baits are marketed competitively as other brands and will further improve with the development of the new bromadiolone baits. AAR Rubber Research Section are marketing improved versions of rain-guards and stimulation-kits (with patents in the pipe-line) as spin-offs from its research work. AAR oil palm material production (seeds, seedling, ramets) as yet cannot meet with the great demand from within and without the groups' estates. In a couple of years, it will become a leading supplier of superior oil palm planting materials.

It appears that AAR is fast becoming a big league player in the commercial plantation research and related business.

HIGHLIGHTS

Rat Baits		
Tissue Culture	-	Orchids Micropropagation of Pineapple
Laboratory	-	Lab.Services/ Foliar Fertilisers
Rubber	-	Rainguard
Oil Palm	-	Breeding & Seed Production

RAT BAITS

Warfarin - based baits have always been proven eco nomical and effective to combat rats in estates. In AAR, the warfarin baits are produced under the trade -name AA Rat Baits and sold at a minimal price to its advisory estates as a service. Continuous efforts are carried out to make the baits effective and competitive with other baits of its kind in the market. Suggestions by our customers and managers are always taken into consideration when improving the bait's effectiveness.

Price-wise our baits have been maintained at $ 20 per box delivered within West Malaysia and is the cheapest on per kg basis in the country. However due to increased cost in production, it is inevitable that the price has to be adjusted to cover the necessary expenditures. Despite the new price of $ 21.50 / 10 kg box (ex-factory), AA rat bait continues to the lowest priced warfarin -based baits around.

Currently AAR is developing a new bromadiolone-based baits to be registered with the Pesticides Board under the trade-name of Brombaits. Information for registration are currently being collated and the baits should be ready for use by late 1993.

Samsudin, A.

Micropropagation of Pineapple through Tissue Culture

The pineapple (Ananas comosus) is a herbaceous plant native to tropical South America. The fruit is a sorosis and consists of a succulent fleshy inflorescence which ripens into a solid mass endowed with tough persistent floral bracts and topped with a crown of small leaves. The cultivars of economic importance in Malaysia can be grouped into 3 i.e. Cayenne, eg. Sarawak; Queen, eg. Mauritius; and Spanish, eg. Masmerah.

In the cultivation of pineapple, slips (shoots arising from the base of the fruit) and suckers (shoots arising from the main stem) are preferred as planting materials to crowns because slips and suckers are more vigorous, with a maturation period of 18 months. Crowns take about two years to mature. Nonetheless, all three types of vegetative propagules are easily available within a stand of pineapple plants. Why then do we require micropropagation techniques to propagate planting materials for pineapple ?

Micropropagation through tissue culture should only be used when a rapid multiplication of planting materials of a desired cultivar or selection is required.Other advantages of using micropropagules are uniform growth and earlier and heavier bearing as observed by MARDI in the papaya tissue culture plantlets. The main drawback will be in the higher cost of producing the micropropagules.

AAR TC LAB ventured into pineapple tissue culture when approached to produce planting materials for two Thai cultivars which are not easily available in Malaysia. The cultivars are Pattawai and Nang Rai which have been selected because of high sugar content and fruit size. About a year was taken to define the protocol for Pattawai. The protocol was then refined using Nang Rai.

The protocol for the micropropagation of pineapple consists of 5 stages as depicted in the diagram below :-

STAGE - 1 :

GERMINATION OF AXILLARY BUD INTO SHOOT

AXILLARY - BUD
4-6 months

↓

STAGE - 2 :
STIMULATION OF SHOOT TO FORM PROTOCORM - LIKE BODIES (PLB)

SHOOT WITH 5-6 LEAVES (LF)
1-2 months

↓

STAGE - 3 :
PROLIFERATION OF PLB

PROTOCORM - LIKE BODIES (PLB)
1-2 months

↓

STAGE - 4 :
GERMINATION OF PLB INTO SHOOTS

SHOOT DEVELOPMENT
2-3 weeks

↓

STAGE - 5 :
ROOT INDUCTION OF SHOOTS

PLANTLET

Micropropagation should only be used when a rapid multiplication of planting materials of a desired cultivar is required

Stage - 1 : The initial explants used are axillary buds from pineapple slips / suckers. Around 12 -14 buds can be obtained from a slip / sucker of one foot in length. The buds are excised under aseptic condition, decontaminated or sterilised before they are inoculated on to culture media to promote bud germination into shoots. It takes about 4-6 months for a bud to attain the 5-6 leaf.stage.

Stage - 2 : Each shoot bearing 5-6 leaves is then stripped off the leaves to expose the incipient axillary buds. The buds are stimulated by pin - pricks before inoculation onto culture media for formation of protocorm - like bodies (PLB). Formation of PLB can be observed within 1-2 months.

Stage - 3 : The PLB can be subjected to futher proliferation or to shoot development depending on the concentration of the exogenous growth regulators used.

On proliferation media, it takes about 1-2 months. before the culture - vessel is filled with masses of PLB which can be subcultured to 4-6 culture vessels for further proliferation.

Stage - 4 : On shoot development media, the PLB germinate into multiple shoots of 3 cm. high (from shoot base to the tip of the longest leaf) with 5-6 leaves after 1-2 months. The shoots are then excised for root induction.

Stage - 5 : 90 % of the shoots will root within 2-3 weeks on root induction media to form complete plantlets which are then ready for transplanting to polybags under field nursery conditions.

Unlike the oil palm, pineapple plantlets do not require a conditioning period to acclimatise them to the outside (of the culture - vessel) temperature and humidity. Survival rate of transplants is around 100 %.

Comparing the response of the two cultivars to the protocol, at Stage - 1, the axillary buds of Pattawai germinated into shoots with 5-6 leaves at two months earlier than Nang Rai. Also, the establishment of PLB (Stage - 2) was one month earlier in Pattawai. Subsequently, the two cultivars responded similarly at stages 3 to 5. To obtain the initial plantlets from the lab, it will take approximately, 6 1/2 - 11 months from Stage - 1 to - 5 as compared to 12 - 18 months to harvest the slips / suckers from existing stand for use as planting materials.

The plantlets have been tested in the field and found to produce normal plants and fruits.

Wong, G.

Tissue Culture for Orchids

Orchids were possibly the first horticultural plant to be propagated by tissue culture. By the 1960's various researchers had already developed tissue culture methods for large scale clonal propagation of some of the more important varieties.

At AAR, the orchid varieties that we currently propagate on a commercial scale are from the genera Aranda, Vanda, Ascocenda, Mokara and Dendrobium.

Our techniques involve principly the use of meristematic tissues from the shoot apices and axillary buds of cuttings as starting materials. The cuttings are normally selected at a young stage with no noticeable floral buds present yet.

The first stage in the orchid tissue culture process involves the thorough sterilisation of the starting materials prior to inoculation in the culture medium.

After sterilisation, the meristematic tissues are excised and inoculated into flasks of liquid media. These flasks are then put into orbital shakers to be shaken continuously. Within 4 to 6 weeks on the orbital shaker, protocorms (embryoid-like structures) are formed. These protocorms are allowed to divide and develop further on the shaker until the flask fills up with protocorms.

The protocorms are next transferred to flasks of agar media and stored in culture rooms for further multiplication as well as development of shoots. At this stage, the cultures are subcultured every two months during which shoots formed are removed and transferred into whiskey bottles (Johnny Walker preferred!) of agar media. About 50 shoots are placed in each bottle and they are allowed to develop in these bottles until they are large enough to be delivered to the client.

The whole process from the time meristems are inoculated to the delivery stage takes between 1 1/2 to 2 1/2 years depending on the varieties.

To ensure a very low to nil rate of mutations or off types, we do not use any aritificial growth regulators in our media. Our media contain only plant nutrients, sugar and coconut water. The cultures rely on the growth regulators in the coconut water. In addition, we also use blended ripe or unripe bananas at certain stages of the process.

Another measure we take to prevent production of off-types, is to limit the production of plantlets to 5,000 per meristematic bud. Thus a cutting can be used to produce anything from 15,000 to 30,000 plantlets depending on the number of buds and the contamination rate of the cultures.

Currently at AAR, we are temporarily halting our orchid tissue culture programme to concentrate our efforts and facilities on the oil palm tissue culture programme.

Tan , C.C.

Proliferating Cultures

Aranda sp

Laboratory Services

1. ROUTINE TESTING OF PLANT, SOIL AND FERTILISERS

Analytical Services at AAR are provided by the Chemistry Laboratory. The Chemist in-charge is Chan Khoon San and routine testing of plant, soil and fertilizer samples are carried out by 5 experienced laboratory assistants under the supervision of Miss Tan Lei Hong. Plant and soil samples are tested according to standardised procedures adopted by all Malaysian laboratories while fertilizer samples are tested according to SIRIM methods using accurate and reliable analytical instruments which are regularly maintained and calibrated.

In addition to AAR, clients using our laboratory services consist of BEA and TPSB estates, agricultural consultants, fertilizer companies, statutory bodies and overseas clients in Papua New Guinea. In 1992, the following samples were tested,

ANALYSIS TYPE

Plant Testing	No. of samples
Major elements N, P, K, Ca, Mg	6104
Minor elements B, Cu, Mn, Fe, Zn	1549
Secondary elements S, Cl	2131
Soil Testing	
pH, conductivity, S, Cl	8
Mechanical analysis o f clay, silt, sand	159
Nutrient analysis	4171
Fertilizer Testing	
Straight fertilizers, mixtures	700
Bunch ash	50
Water samples	1200
Total	16072

TABLE 1: RANKING OF LABORATORIES IN LOCAL CROSS - CHECKS 1990 - 1991
(Laboratories area ranked in order of lowest % rogue)

Lab Code No.	FERTILIZER (1)			SOIL (2)			PLANT (3)		
	Tests No.	Roque %	Rank No.	Tests No.	Roque %	Rank No.	Tests No.	Roque %	Rank No.
1	96	16.7	13	380	11.8	12	360	4.2	8
2	96	7.3	7	380	3.7	6	431	1.2	5
3	96	4.2	3	384	1.6	2	432	0.2	2
4	96	17.7	16	340	18.5	19	364	16.8	21
5	76	18.4	17	384	5.0	8	402	15.2	19
6	96	8.3	9	320	1.9	3	432	4.6	9
7	40	82.5	25	356	5.9	10	396	5.1	11
8	96	44.8	22	384	18.5	19	432	10.0	16
9 AAR	96	1.0	1	380	0.8	1	432	0	1
10	96	32.3	21	332	8.7	11	324	7.7	13
11	96	2.1	2	384	5.7	9	360	0.3	3
12	96	6.2	6	357	2.2	4	432	0.5	4
14	80	22.5	20	-	-	-	426	4.9	10
15	96	9.4	10	316	17.7	17	330	5.8	12
16	80	7.5	8	384	4.9	7	240	1.3	6
17	96	18.7	18	312	13.8	14	252	9.1	15
18	96	4.2	3	384	3.4	5	396	2.5	7
19	32	46.9	23	-	-	-	-	-	-
20	64	17.2	14	-	-	-	240	10.4	17
23	96	12.5	11	280	15.4	15	426	7.7	13
25	80	5.0	5	-	-	-	-	-	-
26	64	21.9	19	-	-	-	324	15.7	20
27	-		-	-	330	17.9	18	-	- -
28	80	17.5	15	-	-	-	-	-	-
29	96	15.6	12	220	15.6	16	328	14.3	18
30	48	81.3	24	128	13.3	13	186	62.4	22

Normal duration between receipt of samples and completion of analysis is 1-2 weeks for fertilizers, 3 weeks for plant samples and 4-6 weeks for soil samples.

2. QUALITY CONTROL OF ANALYTICAL ACCURACY

Accuracy comes first in an analytical laboratory. Wrong results are of no use to the consumer and it is the duty of every laboratory to ensure that all test results are reliable. The 4 main factors in control of analytical accuracy may be expressed by the 4 M Formula.

- Manpower must be well trained and experienced
- Method of testing must follow standardised procedures.
- Machines must be accurate, reliable and well maintained
- Monitoring must be done regularly by cross-check exercises and mistakes must be rectified immediately.

TABLE 2: RANKING OF LABORATORIES IN WAGENINGEN PLANT CROSS-CHECKS 1987-1991.
(Laboratories area ranked in order of lowest % rogue)

Lab Code No.	1987		1988		1989		1990		1991		TOTAL		
	Tests No.	Roque %	Tests No.	Roque %	Tests No.	Roque %	Tests No.	Roque %	Tests No.	Roque %	Tests No.	Roque %	Rank
1	168	5.4	360	6.9	300	7.3	233	7.7	240	3.3	1301	6.3	8
2	300	2.0	360	1.1	360	3.6	360	4.2	240	4.6	1620	3.0	5
3	250	0.4	252	1.6	246	2.8	252	0	204	1.0	1206	1.2	2
4	354	16.1	360	15.3	216	34.7	324	25.0	48	29.2	1302	21.7	13
5	180	2.2	359	10.0	350	19.1	318	11.0	360	10.6	1567	11.5	12
6	294	5.8	360	13.9	360	13.9	360	5.6	120	3.3	1494	9.4	11
7	354	3.7	360	3.1	360	3.1	240	2.1	288	6.6	1602	3.7	7
8	-	-	-	-	114	18.4	-	-	-	-	Discontinued		
9 AAR	360	1.7	360	0.8	360	1.1	300	0	360	0.6	1740	0.9	1
11	360	2.5	360	4.7	360	2.5	354	1.1	294	4.4	1728	3.0	5
12	336	2.4	360	1.4	360	1.1	360	2.2	360	2.2	1776	1.9	3
14	240	6.3	60	10.0							Discontinued		
15	312	6.1	360	4.7	360	6.4	348	8.6	270	13.3	1650	7.6	10
16	120	2.5	120	8.3	216	1.4	192	1.6	168	1.2	906	2.3	4
17	270	8.1	210	5.7	252	9.9	270	5.2	168	5.4	1170	7.0	9

REFERENCES
International Plant Analytical Exchange (IPE) Annual Reports 1987-1991.
Department of Soil Science and Plant Nutrition, Wageningen Agricultural University, The Netherlands.

Through this system of quality control, AAR is able to maintain its position as one of the most reliable laboratories in Malaysia. Results of local and international cross-checks in fertilizer, soil and plant testings show our top ranking in terms of lowest rogue or inaccurate results encountered. Tables 1 and 2 show that our level of error in analysis is less than 1% which is among the lowest in Malaysia.

REFERENCES

1. Fertilizer Analysis Cross-Checks in Malaysia 1990-1991 by Chan Khoon San (AAR)
2. Soil Analysis Cross-Checks in Malaysia 1990-1991 by Ishak Ariffin (FELDA)
3. Malaysian and Wageningen Plant Analysis Cross-Checks 1990-1991 by Poon Yew Chin (OPRS) in Semi nar on Progress in Soil, Plant and Fertilizer Analysis in Malaysia nd the 11th Standardisation Meeting. 4-6 August 1992, Kundasang, Sabah.

FOLIAR FERTILISERS

1. QUALITIES OF AAR FOLIAR FERTILIZERS

The AAR range of foliar fertilizers are formulated on the advice of experienced crop agronomists taking into account the nutrient requirements and commonly encountered nutrient deficiencies and adverse soil problems in horticultural and plantation crops in tropical soil conditions and also the factors required for effective foliar fertilization.

AAR foliar fertilizers possess the following desirable properties required for effective application:

- Specially formulated for crops grown under tropical soil conditions and containing a wide range of formulations to suit varying crop requirements and situations.
- Easy, complete solubility in water and containing a safe and effective wetting agent for good spray coverage and adherence on the foliage.
- High macro-nutrient fomulations and generally high micro-nutrient contents (except Blue and Green which contain the full range of micro-nutrients at lower level).
- Guaranteed formulation with low variation in nutrient composition.
- Compatible with common insecticides and fungicides tested.
- Generally contain low moisture levels (1%-3%)
- Suitable for chloride-sensitive plants because of low chloride level (less than 1%).
- Buffered against pH changes.

The foliar fertilizers are produced by a dry process of mechanical blending, curing and homogenisation. Stringent quality control measures and tests are carried out daily to ensure uniform products up to specifications in the manufacture of AAR foliar fertilizers. Results of tests on daily samples are shown in Table 3 and show that variations of nutrient composition of AAR foliar fertilizers are generally within 5% C.V. (coefficient of variation)

2. TYPES OF FOLIAR FERTILIZERS MANUFACTURED BY AAR

Currently AAR formulates and manufactures over 10 types of foliar fertilizers which are sold by 3 companies using their own brand names as listed in Table 4. While the range of NPK formulations appear comprehensive, there is still a need for a micronutrient formulation containing high levels of Fe, Zn and Mn. For this reason, Microplus was formulated which could be used as a foliar fertilizer by the addition of a stabilizer to prevent Fe precipitation. All our Microplus production is sold to ICI as a supplement for their TE requirements in their compound fertilizers.

TABLE 3:NUTRIENTS COMPOSITION AND VARIATION OF AAR FOLIAR FERTILIZERS

Formulation (Codename)	No. of samples	Average moisture	N		P205		K20		Ca0	
			mean	CV %	Mean	CV %	mean	CV %	Mean	CV %
22:22:10:1 (Yellow)	89	3.3	22.0	5.2	21.6	4.6	10.4	7.5		
21:21:21 (Blue)	88	3.2	19.5	3.0	20.9	2.7	20.5	4.5		
18:33:18 (Green)	80	2.4	18.0	3.4	32.6	1.9	17.5	3.9		
12:26:26 (Red)	55	1.2	13.1	3.5	25.7	3.3	25.6	2.9		
15:15+20 Ca0 (Calplus)	73	10.6	14.8	2.9	15.0	4.7			19.5	2.6
Mean C.V. %				3.6		3.4		2.6		

Note :Results based on 100g samples taken from 25kg bags at the rate of 8 bags per ton (20% sampling intensity)

TABLE 4 : TYPES OF FOLIAR PERTILIZERS MANUFACTURED BY AAR

Agent Brand	Formulation	Type of Usage
ICI		
Grofas Kuning	22:22:101+TE	Starter for seedlings/ornamentals
Grofas Hijau	18:33:18+TE	Growth, general usage
Grofas Biru	21:21:21+TE	Growth, orchids
Grofas Merah	13:26:26+TE	Flowering, fruiting
Grofas Calplus	15:15+20 Ca0+TE	Calcium corrective
Grofas High K	8:14:35+5 ZN	High K and Zn eg. chillies
Behn Meyer		
Spraygrow	15:20:30+TE	Flowering plants
Turf Green	14:14:14:25	Grass, golf course
Bayer		
Orchid Formula	13:20:30+TE	Flowering plants
AAR Products		
Hydroponic N	12:8:11:4:12+TE	Hydroponic formulation for vegetables
Hydroponic K	10:6.5:21:4:9+TE	Hydroponic formulation for fruits
Microplus	10% Fe, 10% Zn, 5% Mn	Micronutrient deficiency correction

3. HYDROPONICS

AAR has formulated 2 complete hydroponic fertilizers which are in solid form and ready to use.Both formulations have been widely tested by RISDA and other agencies and are effected for use on leafy and fruit vegetables. AAR has also tested the vegetable formulation and results are good. This has prompted the setting up of a pilot scale greenhouse to grow pesticide-free vegetables and evaluate the commercial feasibility of hydroponic production of vegetables at AAR. Another benefit of this project is the use of the greenhouse for demonstration to potential clients.

4. PACKING AND SIZES

The foliar fertilizers and hydroponic fertilizers are sold in 1 kg plastic containers and 25 kg sealed plastic bags Microplus is sold in 50 kg woven plastic bags with liner

Chan, K.S

RUBBER - RAINGUARD

AAR Rainguard (Patent No. P19201311)

THE AAR Rainguard was invented by K. Anbarasu, a Senior Research Assistant inAAR. A patent on the product was filed subsequently and a provisional patent No. P19201311 has been received pending full approval.

The AAR Rainguard is an effective, easy to install and inexpensive device for minimising rain interference in rubber.

Observations over several trials showed very good performance of the AAR Rainguard in enabling almost full tapping in the guarded trees compared with unguarded trees which still remained wet.

AAR Rainguard would be most beneficial for young areas (panel BO-1 and BO-2) where canopy is usually very dense.

AAR Rainguard Installation

AAR Rainguard in Operation

Cost of Rainguard :

40 cm - 11 sen per piece
50 cm - 13 sen per piece
60 cm - 15 sen per piece
70 cm - 17 sen per piece

Cost of fixing rainguards - 8 -10 sen per piece

N.B. **Prices of AAR commercial products e.g. AA Rat Baits, AA Rainguard are list-prices. AAR Principals' estates generally get a discout.**

Oil Palm Breeding & Seed Production

When Boustead Estates Agency relinguished its partnership at HRU Sdn. Bhd. in 1986, and formed Applied Agricultural Research Sdn. Bhd. with Taiko Plantations Sdn. Bhd., it inherited half the proven pisiferas (Dumpy-AVROS) used in the HRU IV DxP production, and young plantings of the next generation of improved dura, tenera and pisifera breeding materials. Those were passed to AAR thus allowing it to proceed ahead with breeding and seed-production with minimal delay.

Although AAR has proven pisifera parents, dura mother palms from proven parents were as yet unavailable as the palms were still young. As such AAR sought cooperation from Felda and Industrial Oxygen Industries (IOI) who provided selected surrogate mother palms of proven lineage for AA DxP seed production in the interim period until its own mother palms are fully available.

AAR aims to produce 2-3 million seeds by 1995 mainly to supply to its Principals' estates high yielding yet short-statured commercial planting materials with superior oil extraction and quality.

The balance are to be used in commercial sales, the proceeds of which will help to fund further breeding and agronomic research.

AAR's seed production unit has built, a modern seed-production facility and is staffed by supervisors with more than 10 years' experience

Oil Palm Seed Production

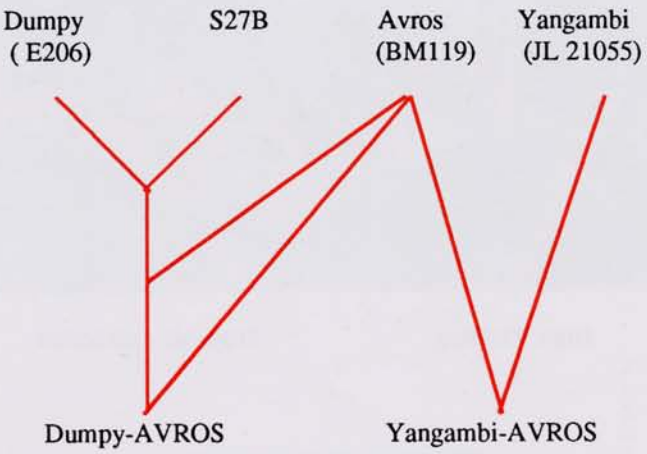
1) AA DxP Production

2) Attributes of AA DxP

a) Legitimacy and quality control

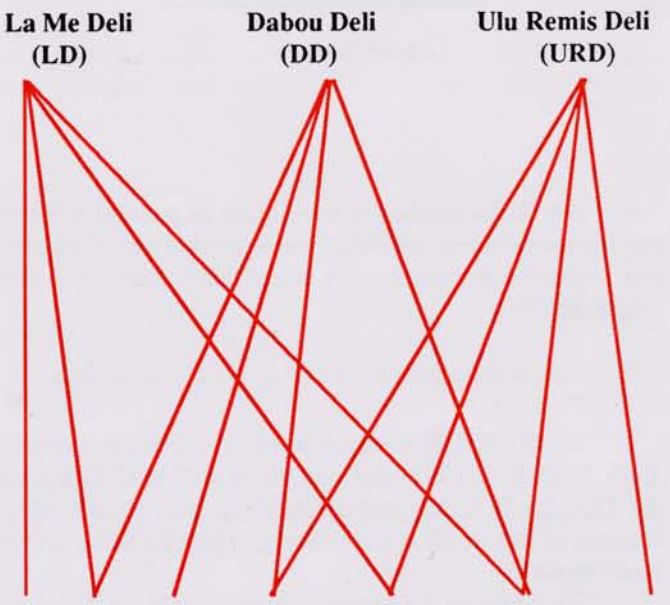
Strict controlled pollination and strict subsequent seed processing and handling ensure minimal illegitimacy and high quality of seeds produced.

b) Superior Pedigrees



AA DxP's Pisifera Lineage

AA DxP pisifera parents inherit the high bunch yield characteristics of S27B, AVROS and Yangambi, the high oil extraction property of AVROS and Yangambi and the short stature of the Dumpy and the Yangambi (short variant).



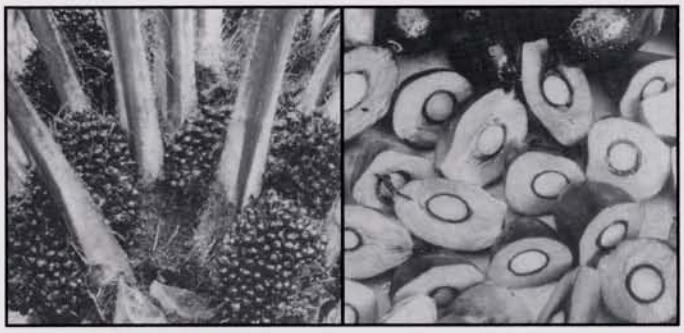
AA DxP's Dura Lineage

Ulu Remis Deli duras are known for their uniform high yields and good oil extraction characteristics.

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

AA DxP dura parents combine the best characteristics from these ancestors.

3) Superior Performance



High Yielding **High oil extraction**

Short Stature

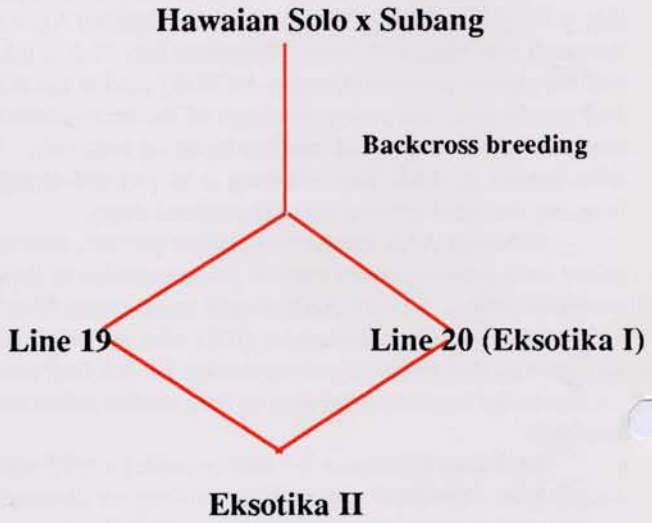
AA DxP material has lived up to its promise of being a precocious yielder with good oil extraction and a small palm stature, important attributes in an increasingly scarce and costly labour market.

Ekostika II Papaya Hybrid Seed Production

Mardi officially released the Eksotica II papaya variety in 1991. From 1987-1991 AAR cooperated with MARDI in testing the Eksotika II variety and establishing seed-garden designs. Because of this, AAR is one of the very few Eksotika II hybrid seed suppliers.

The Eksotika II is a hybrid of Line 19 and Line 20 (released as Eksotika I) which were derived from a backcross breeding programme to incorporate the sweetness and fragrance of the Hawaian Solo papaya to our local variety (Subang). It was developed for the export market hence the smaller size.

Eksotika II is an improvement of Eksotika I in terms of better vigour, high yield and better fruit quality (sweeter, more fragrant, firmer and less freckling).



High yielding **Good fruit quality**

Soh, A.C.