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AAR-NEWS

EDITORIAL

*A*cres of profits! Without a doubt the oil palm has now become a true cash crop. Like all cash/commodity crops, today's soaring CPO prices have increased the profitability of oil palm plantations substantially. Even oil palm waste can generate profits. Cashing in on the potential benefits, BEA is in the process of commissioning the Boustead Biotherm Palmass Plant™ (BBPP). The BBPP is a reactor capable of churning out 15,000 tons of organic fertilizer per annum. However, the profits generated are not only associated with the final product it produces but also through carbon credits sold from the reduction of green house gas emissions. Mr. Ooi Ling Hoak, Principal Research Officer, has written an article on the conversion of POME and EFB into organic fertilizer and BBPP.

Happy reading!!

Tasren Nazir Mahamooth

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Turning POME and EFB into organic fertilizer without waste and discharge

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This is a summarised version of a paper presented at IOPC 2006 Bali

INTRODUCTION

During the processing of oil palm fresh fruit bunch (FFB), about 60 tons of palm oil mill effluent (POME) and 20 tons of empty fruit bunch (EFB) are produced for every 100 tons of FFB processed. POME is a liquid waste consisting of about 6% total solids and 94% water. The solids are essentially organic in nature, 95% of which are volatile solids and have high biochemical oxygen demand (BOD) making it very polluting when discharged into waterways. EFB is the empty fruit bunch after the fruits have been detached and is a solid waste with about 64% moisture content.

POME must be treated to reduce its BOD to an acceptable level before it is allowed to be disposed. The most common treatment system currently is by anaerobic digestion in lagoons or tanks to reduce the BOD to the required levels before discharging into watercourses. EFB were incinerated in the past and the ash returned to the field as potassium fertiliser. Incineration of EFB destroys the organic matter and the bulk of the valuable plant nutrients. It also pollutes the air and is no longer acceptable now. Direct application of raw EFB to the field has been proven to improve both the growth and yield of oil palms (Khoo and Chew 1979; Gurmit *et al.* 1981 and 1990; Loong *et al.*, 1988; Lim and Chan 1990; Hornus and Nguimjeu, 1992). But raw EFB is very bulky and costly to apply. One way to overcome this problem is through composting (Lim, 1989; Goenadi *et al.*, 1998; Schuchardt *et al.*, 1998 & 2006 and Chong, 2005).

The conventional way of treating POME by anaerobic process produces considerable amount of methane. Ma (1999) reported that anaerobic digestion of POME produces a mixture of biogas (65% CH_4, 35% CO_2 and traces of H_2S) and approximately 28 m^3 of biogas could be generated from a ton of POME in lab trials. Yacob *et al.* (2005, 2006) reported a lower level of methane emission from open digesting tanks and anaerobic ponds in two palm oil mills in Malaysia. There is a great potential to reduce this green house gas (GHG) emissions. Schuchardt *et al.* (2006) reported that anaerobic digestion of POME in the anaerobic lagoons of a 30-ton per hour palm oil mill processing 160,000 tons of FFB could generate a carbon credit of about 24,000 tons per annum.

This paper reports the results of an experiment where the composting process was optimised to remove moisture (Richard and Choi, 1996) and to prevent the emission of methane. In the experiment, POME was added sequentially twice a day to the prepared EFB (the bulking amendment) in a specially designed self-draining and ventilated compost reactor called the Boustead Biotherm Palmass Plant™ (BBPP). Based on the results obtained, we have designed a full scale BBPP to compost and dry all the POME and EFB produced in a 30-ton per hour palm oil mill processing 150,000 tons of FFB per annum and turning them into an organic fertilizer. The BBPP will generate 20,000 tons of carbon credit and produce 15,000 tons of organic fertilizer per annum. The plant is estimated to have an internal rate of return of between 5 and 34%.

Keywords:
Boustead Biotherm Palmass Plant™, bio-drying, carbon credit, composting, empty fruit bunch, organic fertiliser, palm oil mill effluent, zero-waste zero-discharge.

MATERIALS AND METHODS

The pilot scale Boustead Biotherm Palmass Plant constructed for the trial is shown *Figure 1.* The process is summarised in *Figure 2* and briefly explained below:

Stage 1 Recovers the residual unstripped fruits and palm oil and prepares the fresh EFB for composting and bio-drying of POME

Fresh EFB from the first round of threshing goes through a crusher (1) to dislodge the fruits not stripped during the first round of threshing. The crushed EFB then undergoes a second round of threshing (2) to recover unstripped fruits. Thereafter the crushed EFB goes through a screw press (3) to recover the residual palm oil left in the EFB peripherals, and finally the pressed EFB is shredded by a cutter (4) to reduce its size and increase porosity (air spaces) turning it into a bulking material for composting and bio-drying of POME.

To determine the effects of step (3), sixteen empty fruit bunches after the second round of threshing were cut into two equal halves longitudinally and paired. One set was passed through the screw press and the moisture, oil and nutrient contents determined together with the other set that were not pressed.

Stage 2 prepares the raw POME at start up to speed up the decomposition and bio-drying process.
In a separate tank, raw POME is enriched with an accelerator (5) at start up to speed up the decomposition and bio-drying process. The prepared EFB from the cutter is discharged onto a conveyor where it is sprayed with the enriched POME. The EFB-POME mixture is then loaded into a self-draining ventilated compost reactor (6) where it remains for an initial period of about 12 hours.

Stage 3 recycling of EFB-POME compost mixture for aeration, further shredding of EFB, homogenising and sequential additions of raw POME.

The EFB-POME compost mixture is recycled twice a day for aeration, downsizing and further addition of POME. This is done by opening the bottom of the reactor and discharging its contents onto the conveyor below. The conveyor conveys the mixture to a cutter (7) where the EFB-POME mixture is further downsized, after which it is further sprayed with fresh POME (8) before being conveyed back to the compost reactor again. This recycling process is repeated for 7 days.

Stage 4 drying of final product by boiler flue gas. On the eighth day, the final product is conveyed to a roll dryer and dried to 30% moisture content using palm oil mill boiler flue gas.

Figure 1 : Pilot scale Boustead Biotherm Palmass Plant

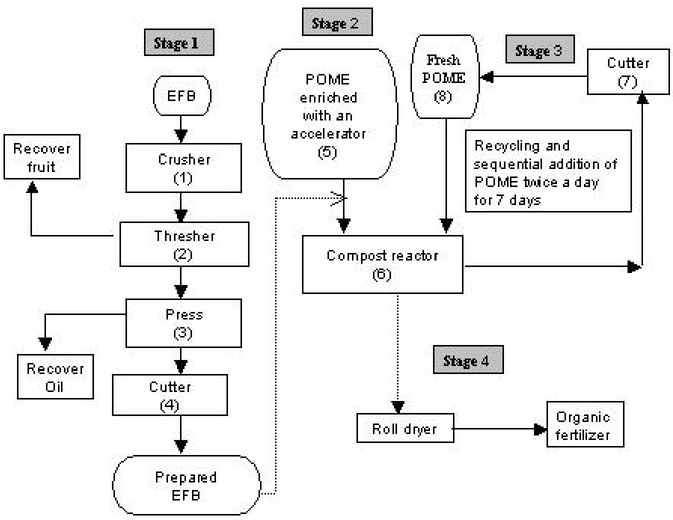

Figure 2 : Turning POME and EFB into organic fertilizer without producing any waste and discharge

RESULTS AND DISCUSSION

Effects of crushing, second threshing and pressing

The effects of passing fresh EFB after crushing and second threshing through a screw press are summarized in Table 1.

The screw press reduced the moisture content of the fresh EFB after crushing and second threshing from about 64 to around 55%. The screw press was able to squeeze out close to 63% of the oil lodged in the EFB, reducing the oil content of the EFB from 11.62 to 4.29%. It is suspected that the recovered oil could contain wax but this was not measured. This oil was subsequently recovered via the digester. Pressing had little effect on the carbon content of EFB.

Apart from oil, the screw press also squeezed out between 12 and 31% of the major nutrients contained in EFB. The largest loss was the loosely bound K, which was reduced by 31% followed in descending order by Mg (29%), P (22%), Ca (14%) and lastly N (12%). However these valuable nutrients were not lost but were recycled through the POME, which were subsequently mixed with the shredded EFB to produce an organic fertilizer and recovered. As the screw press had little effect on the carbon content of EFB while N content was reduced, the carbon to nitrogen ratio was thus increased from the initial

Table 1: Effects of passing fresh empty fruit bunches after crushing and second threshing through a screw press

Parameter (Mean of 16 samples)	Mean (% on dry matter)		% Change
	Before pressing	After pressing	
Moisture (% on sample)	63.90 (0.96)	55.24 (1.10)	14
Oil	11.62 (0.78)	4.29 (0.75)	63
Nitrogen (N)	0.77 (0.03)	0.68 (0.03)	12
Phosphorus (P)	0.091 (0.01)	0.068 (0.01)	22
Potassium (K)	2.35 (0.09)	1.61 (0.08)	31
Calcium (Ca)	0.28 (0.02)	0.24 (0.02)	14
Magnesium (Mg)	0.14 (0.01)	0.10 (0.01)	29
Carbon (C)	49.91 (0.62)	49.32 (0.99)	1
Ash	7.66 (0.29)	5.25 (0.21)	31
C:N ratio	65.76 (1.97)	74.29 (2.97)	13
pH (1 part sample to 2.5 parts water)	5.08 (0.13)	5.20 (0.09)	2

Note: Figures in brackets are standard errors
The following methods were used in the determination of nutrients:
i. C and N by CNS machines ; ii. K by flame photometer method
iii. P by colorimetric method ; iv. Ca and Mg by atomic absorption method

Nutrient content of shredded EFB, raw POME and final product

Nutrient concentration

The nutrient concentration of the shredded EFB, raw POME and the final product (EFB-POME organic fertiliser) is tabulated in Table 2.

There was considerable variation in the nutrient concentration of shredded EFB and raw POME and hence the final product between the two trials. This is due to the inherent variability in these two waste products. One cannot, of course, discount sampling errors.

Although the nutrient concentration of the raw POM was much higher than the shredded EFB on dry matter basis, its moisture content was very high at about 94% compared to about 46% for the shredded EFB. The carbon to nitrogen ratio of the shredded EFB was very high at about 100. This was reduced to about 37 in the final product.

Among the major plant nutrients, the most abundant element in the shredded EFB was K (1.17 and 1.51% on dry matter in Trials A and B respectively), followed in order of abundance by N (0.47%), Ca (0.15 and 0.21%), Mg (0.07 and 0.09%) and P (0.05 and 0.06%). The order of ranking was the same for raw POME and not surprisingly in the final product, EFB-POME organic fertilizer as well. The nutrient concentration of the prepared EFB was increased substantially through sequential additions of raw POME.

Table 2: Nutrient concentration of shredded EFB, raw POME and EFB-POME organic fertiliser

Particular	Trial	Nutrient concentration (% dry matter)							pH	C:N ratio
		Ash	N	P	K	Ca	Mg	C		
Shredded EFB (Mean of 3 samples)	A	4.40	0.47	0.05	1.17	0.15	0.07	47.03	6.05	100
	B	5.42	0.47	0.06	1.51	0.21	0.09	47.82	6.43	101
Raw POME (Trial A 12 samples Trial B 8 samples)	A	16.70	1.87	0.26	3.71	0.82	0.69	43.04	3.87	23
	B	18.38	1.94	0.31	4.36	0.97	0.83	43.75	3.76	22
EFB-POME organic fertilizer (Mean of 3 samples)	A	11.64	1.23	0.17	1.54	0.53	0.28	45.93	5.91	37
	B	10.69	1.24	0.16	2.55	0.52	0.33	45.41	7.31	37
	Increase in nutrient concentration over shredded EFB (%)									
			N	P	K	Ca	Mg			
	A		162	240	32	253	300			
	B		164	167	69	148	267			

Amount of nutrient

The amount of nutrients in the shredded EFB, raw POME and recovered in the final EFB-POME organic fertiliser is tabulated in Table 3.

About 85 to 97% of the N, P and Ca in the shredded EFB and raw POME were recovered in the final EFB-POME organic fertilizer. Recovery of the easily leached K and Mg was lower particularly in Trial A where an excessive amount of POME was added and hence more leaching losses. Their recovery could be improved with more care taken to prevent excessive addition of POME and also better recovery of the excess POME that drained down the reactors and recycling it. This would be done in the commercial scale plant to be built soon.

Table 3: Amount of nutrients in the shredded in EFB, raw POME and recovered in EFB-POME organic fertiliser

Parameter	Trial	Dry matter (kg)	Amount of nutrient (kg)						
			Ash	N	P	K	Ca	Mg	C
Shredded EFB	A	1248	55	5.87	0.62	14.60	1.87	0.87	587
	B	1335	72	6.27	0.80	20.16	2.80	1.20	638
Raw POME	A	919	153	17.19	2.39	34.09	7.54	6.34	396
	B	491	90	9.53	1.52	21.41	4.76	4.08	215
EFB-POME mixture	A	1666	194	20.49	2.83	25.66	8.83	4.66	765
	B	1239	132	15.36	1.98	31.59	6.44	4.09	563
Recovered in EFB-POME (%)	A	77	93	89	94	53	94	65	78
	B	68	81	97	85	76	85	77	66

Boustead Biotherm Palmass Plant™

Carbon credit and organic fertilizer

The BBPP, which utilizes all the POME produced in a palm oil mill for composting with prepared EFB will not require any anaerobic POME lagoons and being a fully aerobic system will not emit any methane. Based on the 1996 Inter-governmental Panel on Climate Change (IPCC) formula and estimates by Yacob *et al.* (2006), our BBPP currently being built to replace the existing anaerobic lagoons in a 30-ton per hour palm oil mill processing 150,000 tons FFB per annum will result in methane emission reduction equivalent to about 20,000 tons of carbon credit per annum. The BBPP will also produce 15,000 tons of organic fertilizer per year (Table 4).

Table 4: Amount of organic fertilizer produced by BBPP processing 150,000 tons of FFB per year

Item	FFB	EFB	POME	Total
Fraction of FFB		0.20	0.60	
Amount (t/y)	150,000	30,000	90'000	
DM fraction		0.35	0.05	
DM before composting (t/y)		10,500	4,500	15,000
DM after composting assuming 30% loss of DM		7,350	3,150	10,500
Organic fertilizer @ 30% MC (t/y)		10,500	4,500	15,000

Economic analysis

An economic analysis of the proposed BBPP using the net present value (NPV) and payback period (PBP) discounted at 10% rate of interest, and internal rate of return (IRR) was carried out. Details of assumptions made are in Appendix1 and the NPV, IRR and PBP obtained are summarized in Table 5. Depending on the prices assumed for organic fertilizer and carbon credit, IRR of between 5 and 34% could be expected.

Table 5: Net present value, internal rate of return and payback period

Life span (y)	NPV discounted at 10% (RM '000)			Internal rate of return (%)			Pay back period discounted at 10% (y)		
	LP	MP	HP	LP	MP	HP	LP	MP	HP
7	-1,024	1,853	6,058	5	18	34	>7	5	3
10	461	4,091	9,398	12	23	37	8	5	3

Note: Life span of 7 yrs is based on the letter of intent to be signed between ourself and the Danish Ministry of Foreign Affairs

CONCLUSIONS

The novel pilot scale Boustead Biotherm Palmass Plant™ (BBPP) set up to develop a method of turning POME and EFB into an organic fertilizer without generating any waste and discharge by composting was able to evaporate up to 1.14kg water/kg EFB dry matter/day over a 7-day period. The pilot plant was able to recover the bulk of the nutrients in the prepared EFB and raw POME in the final product, EFB-POME organic fertilizer. At the same time, more than 60% of the oil trapped in EFB was recovered. It is suspected that the recovered oil could contain some wax but this was not measured. The absence of malodour, the high temperature and pH achieved confirm efficient composting. The considerable loss of dry matter and the high amount of water evaporated over a relatively short period of seven days indicate that decomposition was fairly rapid and a high level of bio-drying was achieved.

Based on the results obtained, we have designed a commercial scale BBPP to convert all the POME and EFB produced a 30-ton per hour palm oil mill processing 150,000 tons FFB per annum into an organic fertiliser by composting and bio-drying. The organic fertilizer produced is lighter and less bulky than the raw POME and EFB and has a high nutrient content, thus saves transport and application costs. The patent-pending BBPP will replace the existing anaerobic lagoons and eliminate the emission of methane and hence will be eligible for carbon credit and generate additional revenues. This zero-waste zero-discharge BBPP will improve recycling of nutrients, help to protect watercourse and environment, and contribute to the sustainability of oil palm plantations. An internal rate of return of between 5 and 34% could be expected.

ACKNOWLEDGEMENT

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Agricultural Crop Trust (ACT)

This book contains reviewed and edited papers presented at the seminar on *Mucuna bracteata*: A Cover Crop and Living Green Manure (29th November 2006, Sg. Tekam, Pahang) plus a new chapters on "The cultivation of *Mucuna bracteata* – A pictorial guide", Question & Answer session and over a hundred color photographs.

Contents

- Botany, habits and economic uses of *Mucuna bracteata* DC. ex Kurz
  Chiu, S.B.
- Nodulation of *Mucuna bracteata* and acid tolerance of its *Bradyrhizobia*
  Mathews, C., Shamsudin, Z.H. and Xaviar, A.
- *Mucuna bracteata* seeds and seed quality
  Chee, C.F.
- Nursery and field establishment of *Mucuna bracteata* in oil palm plantations
  Lee, C.T., Izwanizam, A., Chu, K.C. and Hii, J.M.
- Agronomy of *Mucuna bracteata* under oil palm
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- Kulim's experiences with establishing *Mucuna bracteata* under oil palm
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- Lyman Agro's experiences with establishing *Mucuna bracteata* DC. ex Kurz under oil palm in Indonesia
  Chiu, S.B. and Siow, A.
- *Mucuna bracteata*, a cover crop and living green manure under the oil palm: future work and a generalised policy for its establishment
  Goh, K.J. and Chiu, S.B.
- The cultivation of *Mucuna bracteata* – A pictorial guide
  Goh, K.J.
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GIS based site specific management of oil palm

Suswanto T & Goh KJ

Geographical Information System (GIS) and Site specific management (SSM) have the capacity to store and utilize geographical referenced information to increase the precision of oil palm cultivation. They can assist in more precise land evaluation, site-specific assessment and management of estate operation.

In land evaluation, GIS can analyze information such as contour map, terrain map, land unit map and satellite images for oil palm suitability assessment. By combining SSM and GIS, recommendation maps can be produced to provide site specific treatments. Since treatments are only given to needed areas at specific optimum rates, savings of input materials and labour can be achieved. GIS based technology also helps in daily estate operation such as monitoring work in progress, field assessment and recording number and quality of bunches harvested. They also assist the estate management to achieve the site yield potential

Water cycling in mature oil palm on rolling terrain

Mahamooth TN, Sim CC, Gan HH, Kee KK, & Goh KJ

Water cycling and balance estimations for three climatic zones in Malaysia were carried out using data from three trials. Results indicated that mean yearly evapotranspiration rates accounted for up to 61% of annual rainfall, while the balance was lost through surface runoff and leaching. Water partition studies based on destructive sampling indicated that annual water uptake by the oil palm is very small. An average of 0.24% of annual rainfall is stored within the oil palm vegetative matter, while an average of 0.04% is lost through fresh fruit bunch (FFB). Therefore, for every 1 t of water taken up by the palm, 2.4 kg of dry matter is produced.

Correction of copper deficiency of oil palm on deep fibrous peat in Riau, Indonesia.

Sugandi A, Goh KJ, & Gan HH

Copper (Cu) deficiency is common among young oil palms planted on deep fibrous peat in Riau, Indonesia. Many sources of Cu fertilizers are available but not all of them have been tested for their effectiveness in correcting Cu deficiency of oil palm. A 1-year trial was therefore conducted on three year old palms with the primary objectives to determine the optimal rates, types and methods of applying Cu fertilizer to correct Cu deficiency. Results showed that all tested Cu fertilizers were capable of overcoming Cu deficiency of oil palm. However, Cu uptake by oil palm was higher with EDTA-Cu than $CuSO_4$ fertilizer. The residual value of EDTA-Cu was also longer than $CuSO_4$. Application of $CuSO_4$ gave similar results as Cu oxysulfate and fritted Cu in terms of Cu uptake by the oil palm. The leaf Cu concentration reached a peak about one month after applying $CuSO_4$ but it took about three months when the less soluble Cu oxysulfate and fritted Cu were applied. A second peak in leaf Cu concentration was detected at the ninth month with fritted Cu. Soil application of soluble Cu was more effective than foliar Cu spray in increasing Cu concentration.

Hydraulic conductivity and moisture characteristics of tropical peatlant - Preliminary Investigation

Melling L, Ayob K, Goh KJ, Uyo LJ, Sayok A, & Hatano R

The hydrological condition and its related moisture characteristics of the soil are important factors to forest and plant growth in peatland ecosystem. These hydrological characteristics would also provide an indirect view point of the current management practices in the case of land cover other than natural forest. This paper reports our recent research findings on the behavior of field hydraulic conductivity (K) and moisture characteristics of peatlands typically found in Sarawak. The field hydraulic conductivity measurements were carried out on different forest types, namely mixed peat swamp, Alan forest and Padang Alan forest in the virgin peat swamp forest at Loagan Bunut National Park using auger hole and pumping method. The moisture characteristics of peat materials were obtained from samples taken from different areas in Sarawak representing different degrees of peat decomposition under various agronomic activities. The moisture characteristic determination was conducted in the laboratory using a combination of sand/kaolin box for suction pressure less than 500 cm (pF<2.7; <0.5 bar) and pressure box for suction pressure membrane appratus for 500-15000 cm (pF 2.7-4.2 or 0.5-15 bar).

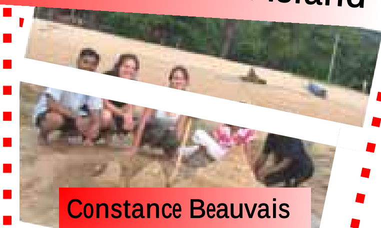
Peat materials from different ecosystems behaved differently in terms of its hydraulic conductivity. The hydraulic conductivity values depended on the hydraulic gradient and the degree of decomposition of peat. Generally, the higher the hydraulic gradient, the greater the K value. This implies that under shallower water table, the drainage process would occur slower thus more favourable to plant growth through maintaining the soil moisture status. However, it would also imply the higher likelihood of flooding. The K value was directly proportional to the degree of decomposition.

All abstracts were adapted from the "*Proceedings Soils 2007: Peat and other soil factors in Crop Production; 17th—19th April 2007; Mukah, Sarawak*".

SOCIAL AND PERSONAL

The year has come and gone and as usual 2007 saw AARSC playing host to a string of exciting events. This year, we managed to arrange a trip to the serene and tranquil Tioman Island. The tiring trip by bus and ferry paid off for the 117 members of staff who went. With packed lunches by the beach and snorkelling in the crystal clear waters, this trip was truly a memorable one. We also managed to arrange a day trip to the Sungai Chongkak waterfalls. Both the young and old enjoyed themselves wholeheartedly frolicking among the boulders and refreshingly cool waters.

AARSC trip to Tioman Island



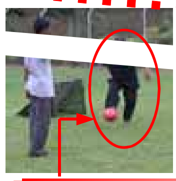
Constance Beauvais & Lucille Glodt (from ISTOM, France) on holiday in Tioman Island

AARSC trip to Sg. Chongkak, Ulu Langat

The year was als... with fun-filled sports activities. This year AARSC managed to organize a badminton ...ment, the TC lab and Paloh sports days, and the Inter-branch Games whi... brought together all t... sports buffs representi... the various AAR su... stations.

To end the year, w... organized the AARSC annual dinner. From all over the country, buses ferrying o... staff converged at the Rahman Putra Golf Club. The night was truly a spectacul... end to the year with everyone dressed in their fine and glory. To add to the sple... dour of the night, members of our staff represent... the different sections/substations entertained us with a series of dances, and in addition there were lucky draws for the 88 prizes. To show our appreciation, a series of awards were given out to well-deserving staff for their dedication and also to the children of AAR staff to acknowledge their educational achievements.

Choo, CN
AARSC President (2007)



Fadzilah-AAR receptionist cum Goalkeeper of the year

AARSC ANNUAL DINNER (2007)

Ms. Choo Cin Nee (AARSC President)

CONGRATULATIONS

LONG SERVICE AWARDS FOR 2007	Encik Balan a/l Kandasamy (Paloh)
25 YEARS AND ABOVE	Encik Md. Zain bin Miskan (Paloh)
Dr. Kee Khan Kiang (DR, AAR)	Encik Abdul Rassid bin Mohamed (Paloh)
Mr. Tan Cheng Chua (PRO, AAR)	Puan Norizan bt. Ibrahim (TC Lab)
Puan Rosita bt. Mohd. Akhir (TC Lab)	Encik Ahmad Zulkarnaen bin Hamdin (Sg. Buloh)
Encik Sandrasegaran a/l Veerappan (SP Lab)	***OTHER AWARDS***
10 YEARS AND ABOVE	**DEDICATION AWARDS**
Encik Asrul Afandi bin Mohamad Jonah (Paloh)	Mdm Chandrika a/p Maniam (TC Lab)
Encik Suresh a/l Selvaraj (Paloh)	Puan Hatina bt. Mohamed (TC Lab)
Encik Shabry bin Ahmad (Chemistry Lab)	Puan Nor Azian bt. Atan (Paloh)
Encik Zulkifli bin Zakaria (Chemistry Lab)	Ms Tan Ching Mooi (Main Office)
Puan Hanifah bt. Kolian (TC Lab)	**INITIATIVE AWARDS**
Puan Siti Kalijah bt. Bahrrin (TC Lab)	Encik Shamsuri bin Samsuddin (Paloh)
Encik Amran bin Abd Rahman (Balau)	Mdm. M. Sarawathy a/p Mangdi (Paloh)
Encik Krishnan a/l Balakrishnan (Balau)	Encik Muhamad bin Abdullah (Sabah)
EMPLOYEE OF THE YEAR AWARD: Encik Sandrasegaran a/l Veerapan (SP Lab)	

CONGRATULATIONS

MARRIAGE

Encik Asraf Bin Mohamad Idrus to Cik Nur Shafinie Bt Abdullah on 01/12/2007

Encik Mohd Redzuan Bin Mohd Razali to Cik Noor Faizah Bt Aziz on 25/12/2007

BIRTH

- ⇒ Encik Ahmad Zulkarnaen on the birth of his son Danny Haiqal on 03/03/07.
- ⇒ Puan Nasniza on the birth of her son Mohd Alif Haikal on 11/03/07.
- ⇒ Madam Lynda Anne on the birth of her son Leonerd Joachim on 21/03/07.
- ⇒ Puan Masnita on the birth of her son Amrin Hafiz on 20/05/07.
- ⇒ Puan Aspalila on the birth of her son Adib Fahmi on 11/06/07.
- ⇒ Puan Salnieza on the birth of her daughter Nurul Aierien on 17/07/07.
- ⇒ Encik Haeri on the birth of his son Hazril Haqimi on 03/10/07.
- ⇒ Encik Taliu on the birth of his daughter Ana Syafiqa on 17/11/07.
- ⇒ Mr. Mathan and Madam Jeyanthi on the birth of their son Rehan on 06/12/07.
- ⇒ Mr. Selvarajah on the birth of his son Yooginesh on 10/12/07.

WELCOME

We would like to take this opportunity to welcome **Mr. Ng Woo Jian** who joined us on 15/July/2007 as a Research Officer.

Ng Woo Jian born in 1965 in Kluang, Johor. He obtained his Diploma of Agriculture from University of Agriculture Malaysia (UPM) in 1989. After completing his diploma, he worked in the private sector as a planter (1990-1991) then joined the government sector where he worked as a Research Assistant in cocoa breeding with Malaysia Cocoa Board based in Tawau, Sabah (1992-1996). In 1997, he joined FELDA Agricultural Service Sdn. Bhd. as a Research Assistant in oil palm breeding. In 1998, under a scholarship granted by FELDA, he pursued his degree at Universiti Putra Malaysia (UPM). Upon completing his degree in 2000, he continued working with FELDA as a Research Officer in oil palm breeding (1997-2007). On 15/July/2007, he joined AAR as the Seed Production Manager in Paloh, Kluang. Currently he is involved in AAR seed production work where he is responsible for the laboratory's daily operation and quality control.

NEW STAFF RECRUITMENTS

Name	Date Joined
Cik Norshahira Bt Ahmad	09/04/07
Cik Patimah Bt Hashim	09/07/07
Cik Nadiah Bt Taib	16/07/07
Miss Shirley A/P Arokiasamy	01/08/07
Pn. Tengku Norazreen Bt T. Zahrin	01/08/07