AAR
Hall of Fame 2016

Each year, AAR recognizes outstanding individuals who have contributed significantly to the company. Awards for the year of 2016 were presented to the following employees:

10th Year Long Service Award

Employee	Section
JUNNAIDI BIN JAMIL	SP LAB.
SUMATHI A/P PERIASAMY	SP LAB.
DAHLIANA BINTI ABDULLAH	SP LAB.
ARBIAHYAH BINTI ANIS	SP LAB.
SHANTI A/P SUBRAMANIAM	SP LAB.
POVANESVARY A/P MUTUKAN	TC LAB.
SIVAPACKIAM A/P KUTTAR	TC LAB.
NADIATUL IKMA BINTI SAMAH	TC LAB.
TAYALAN A/L ALAGIRI SAMY	TC LAB.
THENMOLEY A/P MANIAM	TC LAB.
MOHD AZLAN BIN AHMAD	TC LAB.
MADINAH BINTI LEWON	TC LAB.
SITI RAHAYU BINTI SUPIAI	PALOH
ADMUSZIFA BINTI MAT DIAH	TC LAB.
VASANTA A/P MALAYANDI	TC LAB.
KALAADEWI A/P VEERAN	TC LAB.
ZALEHA BINTI ABDUL RAHIM	TC LAB.
SITI NORMAH BINTI AHMAD	TC LAB.
NORZAILI BINTI ROSTAM	TC LAB.

25th Year Long Service Award

Employee	Section
KUMAR A/L KRISHNAN	PALOH

Dedication Award

Employee	Section
NORASEKIN BT ANUAR	TC LAB.
RUKMANY DEVI A/P VENGEDASAMY	CHEM LAB.
LUTCHUMY A/P POOSARI	P&D LAB.
ZAINUDDIN BIN HUSSIN	PALOH

Employee of the Year

Employee	Section
NOR FAZHILAH BT JUMRI	P&D LAB.

Congratulations and well done to all award recipients!

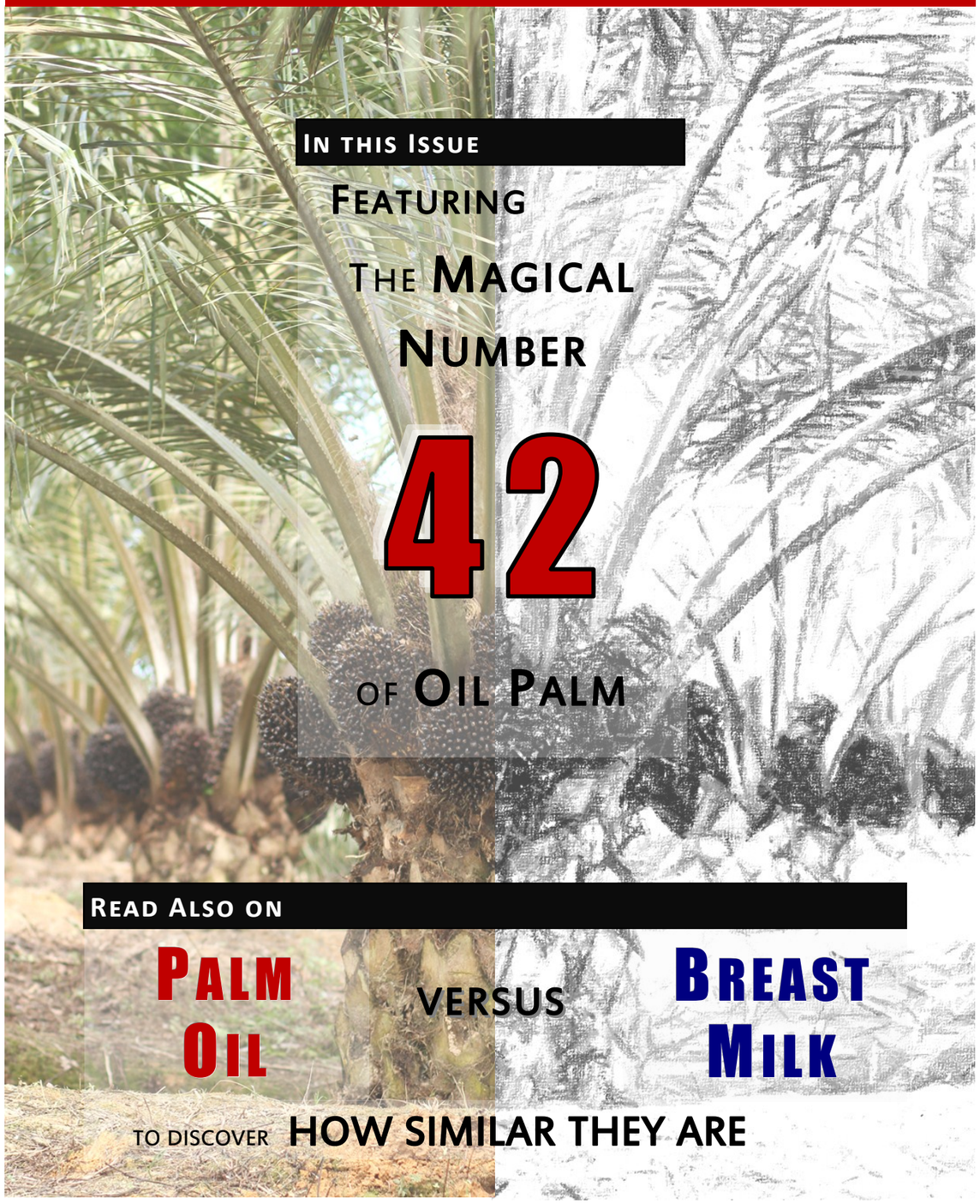
Letter from The Editor

Yet another year has passed, and AAR continues to strive for excellence in the agricultural industry.
This issue covers two interesting articles from AAR; one that deciphers the fate of oil palm in relation to the number, 42, while the other offers a little insight into palm oil from the health perspective. We hope you enjoy the read!

Best regards
Goh Chai Yeen

AAR Newsletter

May 2017



Oil Palm and the Number 42

K. J. GOH

Introduction

Crops For the Future (CFF), University of Nottingham Malaysia Campus (UNMC) and Centre for Ecology and Hydrology (CEH), Natural Environment Research Council, United Kingdom jointly organized a workshop on "Soil quality challenges in Malaysian and Indonesian oil palm plantations" in UNMC from 2nd to 3rd March 2017 and one of the most interesting presentations was by the foremost crop modeler, Prof. Dr. Meine van Noordwijk, Chief Science Advisor, International Centre for Research in Agroforestry (ICRAF), World Agroforestry Center, who gave his insight into the number 42 in oil palm. So, what does the number 42 got to do with oil palm? The next few figures from van Noordwijk should illustrate and answer this question.

Yield Potential of Oil Palm

Woittiez *et al*. (2017) in a comprehensive review of the yield gaps in oil palm in Indonesia estimated the potential yield of oil palm at **42** t FFB ha^{-1} yr^{-1} (*Figure 1*). This is the highest physiologically possible oil palm yield under ideal planting materials, planting practices, management and environmental conditions. This figure sets the upper yield limit to identify yield gaps in oil palm plantations, allowing plausible and practical solutions to be identified to overcome those constraints (Goh *et al*., 2002).

Figure 1: Potential FFB yield of oil palm.

Aboveground carbon stock of oil palm

The aboveground biomass carbon of oil palm has attracted much attention from the western world primarily as a major reason to stop planting of oil palm in logged over, degraded forests or old belukar. Khasanah *et al*. (2015a) studied the time-averaged aboveground carbon stocks of oil palm plantations on mineral soils in Indonesia and found that the upper limit was **42** t C ha^{-1} (*Figure 2*). The latter C includes previous vegetation left after land clearing and ground vegetation. But, more importantly, we should be aware that primary forest biomass is usually held to be in a steady state i.e. no net C sequestration and therefore, has no impact on global C cycle or climate change. On similar note, the C debt of oil palm for forest should then be equivalent to the aboveground C stock of oil palm ecosystem at the time of replanting i.e. 84 t C ha^{-1}, which is a similar consideration used in HCS+ study (Raison *et al*., 2015).

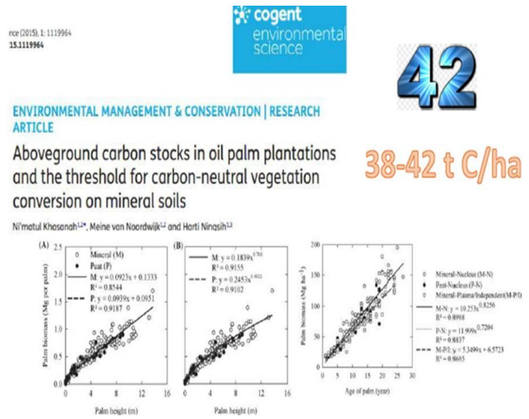


Figure 2: The time-averaged aboveground carbon stock of oil palm.

Soil C stock under oil palm

Khasanah *et al*. (2015b) asked the question of whether the oil palm ecosystem is C neutral and they answered it by investigating the soil C change

AAR Promotions 2017

Officers

Dr. Goh You Keng	Principal Research Officer
Dr. Liew Yew Ann	Research Officer
Dr. Teo Tze Min	Research Officer
Goh Yit Kheng	Research Officer
Chen Zi Yan	Research Officer
Goh Mean See	Assistant Research Officer II
Elza Sisilia	Manager

Clerical & Non-clerical Staff

Selvarajah a/l Chandran	Research Clerk Special Grade (SG)
Sarina binti Rusman	Research Clerk Grade II
Norhafizah binti Md Zulkiply	Research Clerk Grade II
Akqilah binti Saari	Research Clerk Grade II
Lutchumy a/p Poosari	Research Clerk Grade II
Shabry bin Ahmad	Lab. Assistant Grade I
Zulkifili bin Zakaria	Lab. Assistant Grade I
Mohd. Zulkarnai bin Zulkifili	Lab. Assistant Grade II
Santhakumari a/p Ponnampalam	Lab. Assistant Grade II
Kalaivani a/p Ganesan	Lab. Assistant Grade II
Kavitha Danker a/p Henry George	Lab. Assistant Grade II
Nurul Atikah binti Ramli	Lab. Assistant Grade II
Abdul Razak bin Musa	Research Assistant Special Grade (SG)
Mohd. Rustam bin Mamat	Research Assistant Grade I
Ismail bin Hassim	Research Assistant Grade I
Rajendren a/l Subramaniam	Research Assistant Grade I
Asrul Afendi bin Mohamad Jonah	Research Assistant Grade II
Sareday a/p Kunjukanno Raman	Research Assistant Grade II

Non-clerical Staff (NCS)

Rosnizal bin Roslan	Research Operator Grade II
Rohaida binti Rosman	Research Operator Grade II
Zaimi bin Idris	Research Operator Grade II
Roslidah binti Ahmad	Research Operator Grade II
Herman bin Ali	Research Operator Grade II
Zaidah binti Idris	Research Operator Grade II
S.V. Sumathi a/p Sannyasi	Lab. Operator Grade II
Asliyana binti Ahmad	Lab. Operator Grade II
Hadijah binti Jamil	Lab. Operator Grade II
Kasturi a/o Nagalingam	Lab. Operator Grade II

General Workers to Non-Clerical Staff (NCS)

Rafeah binti Wahab	Research Operator Grade III
Razali bin Dollah	Research Operator Grade III
Md. Ridzuan bin Yahya	Research Operator Grade III
Ashari bin Supanterio	Research Operator Grade III
Mohd. Satar bin Ishak	Research Operator Grade III
Chandran a/l Nadasan	Research Operator Grade III
Nordasima binti Abd. Halim	Research Operator Grade III

Congratulations on the promotion!

PTAARI New Recruits

AHMAD MUZZANI, SP

Agronomist / Graduate Research Assistant

BSc (Agribusiness)
Universitas Sumatera Utara, Indonesia
Class of 2015

Joined 2016

HANS ERAWAN, S. PSI, M. PSI

HR & Legal/ Assistant Manager I

MSc (Industrial & Organizational Psychology)
Universitas Medan Area, Indonesia
Class of 2015

Joined 2016

MUHAMMAD GIRI WIBISONO, M. SI

Agronomist / Assistant Research Officer I

MSc (Soil Agrotechnology)
Institut Pertanian Bogor, Indonesia
Class of 2016

Joined 2016

PTAARISC

Social News & Events

In-house Motivational Seminar

An in-house seminar was held on 29 Oct 2016, with Bapak Santoso being invited as the speaker. In the seminar, he kindly and enthusiastically shared on how to stay motivated at work day-to-day. Aren't we all pumped up now?!

Sports Tournament & Annual Hi-Tea

We started off December with a sports tournament where morning aerobics and friendly badminton and futsal matches were held. The annual hi-tea was held later in the month at Novotel.

Fruit Party

What's better to kick start a new year than a fruit party? On 20 Jan we indulged in a range of tropical fruits to celebrate the new year. Durians, rambutans, watermelons… Oh the sweet-savoury goodness!

1st Research Recorder (RR) Retirement Gathering

Bapak Hermanto Sitorus was one of the AARI RRs placed in the Nilo Field station. A retirement gathering was held on 24 Mar 2017 in the field station to mark his service in PT AARI since 2008.

in the top 30 cm in oil palm plantations in Indonesia (*Figure 3*). And, the answer was of course **42** t C ha^{-1} and on average, oil palm plantations are C neutral. The IPCC default estimate of annual CO_2 losses from oil palm on organic (peat) soils is **42** t CO_2 ha^{-1} yr^{-1}. Therefore, oil palm on peat soil is C neutral too. A few studies mainly by non-oil palm practitioners showed that soil C declined over time in oil palm plantations and are not C neutral but all of them either did not consider soil bulk density, the differential soil C in different distinct microsites (Goh *et al*., 1996) or across sufficient oil palm plantations, quite unlike the study by Khasanah *et al*. (2015b) and thus, scientifically defective or invalid.

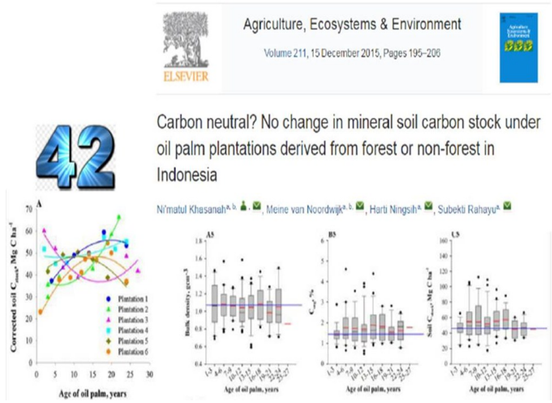


Figure 3: Soil carbon stock of mineral soils under oil palm plantations.

Emission saving of palm oil as biofuel

About 20% of palm oil is converted to biofuel mainly in Europe and South America. There is also a small market in Southeast Asia to meet the government commitment to substitute part of the fossil fuel with biofuel. In Europe, the feedstock for biofuel must have a C emission saving of 35%. van Noordwijk *et al*. (2016), using modeling approach, showed that the C emission saving achievable by using palm oil as biofuel is **42**% (*Figure 4*). However, if oil palm mills practice methane capture, the C emission saving will increase to a whopping 63%. Nevertheless, if global warming is indeed caused by CO_2, then logically any agricultural feedstock with an emission saving of more than 0% C should be suitable for conversion to biofuel and not the politically motivated European Union standard of 35%, which is used to protect its agricultural sector.

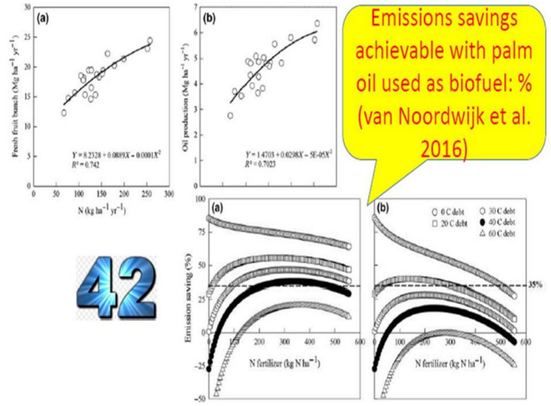


Figure 4: Carbon emission saving achievable with palm oil as feedstock for biofuel.

Oil palm areas under smallholder farming

van Noordwijk (2017) in his presentation contended that **42**% of the oil palm areas are managed by smallholders in Indonesia. Worldwide, about 52% of the oil palm areas belong to smallholders (Goh *et al*., 2017), which shows the importance of this golden crop to the underprivileged people.

Phyllotaxis (frond arrangement) of oil palm

Further to van Noordwijk's insight, I have been asked many times why the oil palm is so efficient in capturing sun rays for photosynthesis. The answer lies in its phyllotaxis where 8 fronds spiral in one direction and 13 in the other. This follows the unique Fibonacci numbers where the ratio, 13:8 (1.625), is close to the golden ratio of 1.618, which affords a perfect frond arrangement without gap. Less mathematically, if we look at the oil palm from below, the Frond No. 9 is not perfectly under Frond No. 1 but skews a little to the right or left depending on whether it is a left hand or right hand palm. Drawing a straight line down from Frond No. 1 to the next whorl of leaves, and it will probably meet a position close to Frond No. 8.5. This gives the average angle between two fronds, which is 360° divided by 8.5, or as you might have guessed, the magical **42** in degree.

Conclusion

In summary, the most essential features of oil palm are associated with the number **42** (*Figure 5*). Is this a coincidence or is nature playing a game with us? Perhaps, the oil palm, which is the most efficient vegetable oil crop in the world and used by human for over 5,000 years, has chosen the number **42** in its evolution, which happens to be a triple 10 or 101010 in binary code, which is easy to remember. But, alas, in Cantonese it does not sound too great.

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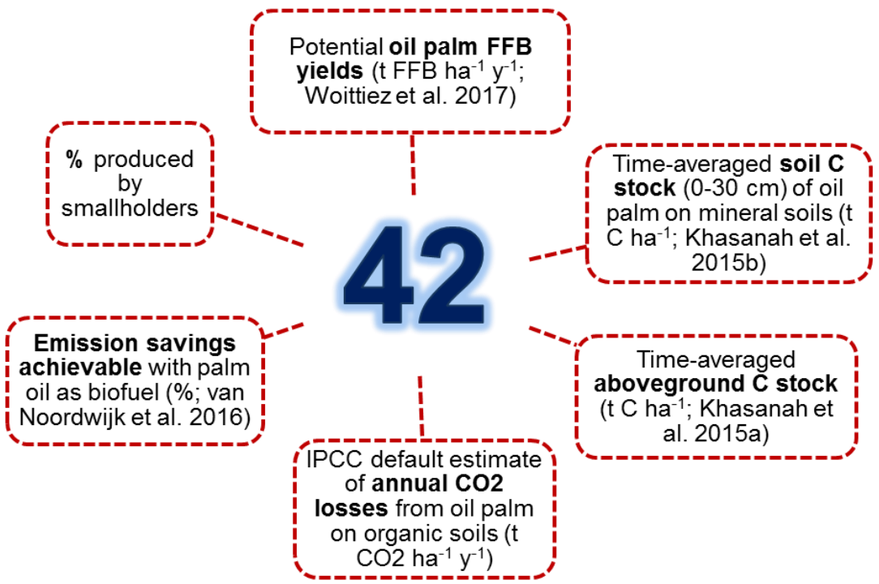

Figure 5: The main features of oil palm and their association with the number, 42.

Annual Luncheon 2016

On the 30th anniversary of AAR, the annual luncheon was held in One World Hotel on 12th Nov 2016. This was the first time a luncheon was held instead of a dinner, and a good turnout to the event was obtained. The luncheon was led by our dedicated emcees, Mr. Chin SY and Hafifi, who brought the crowd to life along with performances by our colleagues from Paloh. Best-dressed awards, AAR's dedication awards and lucky draws were also presented during the luncheon.

AARSC

Social News & Events

Raya & Fruits Festival 2016

Members of AAR enjoyed a big feast on 11th August 2016 in conjunction with Hari Raya 2016. On top of that, the feast was complemented with cartons and cartons of D11 durians from Pahang, as recommended by Mr. Tey SH and transported all the way from Bentong by En Shamsudin Salleh. Despite burning a hole in the accounts, the durian-filled air and finger-licking moments made it worth every cent we have spent!

Langkawi Trip 2016

AAR's 2016 annual trip took place in Langkawi Island on 25—27 August 2016. With the theme of Langkawi Sweet Escape 2016, participants enjoyed visits and strolls in the Langkawi Wildlife Park, Pantai Cenang, Pulau Dayang Bunting, and the cable car. Island hopping and eagle feeding sessions were also part of the exciting itinerary. In addition to getting close to the nature, participants also splurged on chocolate shopping on the duty-free island and sang their hearts out during the karaoke session!

The trip was partially sponsored by AARSC and was open to AAR employees of all offices/ substations.

More photos next page!

Palm Oil and Human Breast Milk:
Fat Distribution and Cholesterol Content

M.S. GOH & K.J. GOH

Mothers have no qualms or reservations feeding their child with breast milk. In fact, for most infants, it is the only impeccable food needed for their healthy early growth and development. This is because of the unique composition of human breast milk which provides newborns with nutritional and physiological needs. Well, what do all these have to do with palm oil? The answer is, amongst the major vegetable oils, palm oil has the closest fat or fatty acid composition compared to human breast milk (*Table 1*). The saturated fatty acid component of palm oil is only 4% higher than human breast milk whereas its monounsaturated and polyunsaturated fractions are even closer at only 2% lower each. In terms of fatty acid composition, no other major vegetable oils come even close in resemblance to human breast milk. For example, the fatty acid compositions of soybean and sunflower oils are heavily polyunsaturated at over 60% while canola and olive oils are mainly monounsaturated at over 63% and coconut oil is nearly saturated at 96%.

The fatty acids in palm oil and human breast milk are mainly made up of three major fatty acids, namely palmitic (C16:0), oleic (C18:1) and linoleic (C18:2) (*Table 2*). The unsaturated fatty acid compositions of palm oil are nearly identical to human breast milk. However, its palmitic fatty acid fraction is about 56% higher. Many non-government organizations (NGOs) and dieticians have associated the high palmitic acid content in palm oil with high risk of cardiovascular disease (CVD) despite the lack of strong, scientific evidence. In fact, it is now well established that the absorption of palmitic acid depends also on the position where the fatty acids are esterified *i.e.* s*n*-1, s*n*-2 or s*n*-3 (Lopez-Lopez *et al.*, 2002). The human digestive system absorbs mainly s*n*-2 fatty acids. In palm oil, its palmitic acid is mostly esterified in the s*n*-1 position, less frequently in s*n*-3 and rarely in s*n*-2 position (Fattore and Fanelli, 2013). This implies that the absorption of palmitic acid into human blood stream is limited. On the other hand, the s*n*-2 palmitic acid content of human breast milk (17.4%) is four times higher than palm oil (*Table 2*).

Table 1:Percent Composition of Fatty Acids for Human Breast Milk and Different Plant Oils.

Source	%Fatty Acids			Cholesterol (mg/kg)
	Saturated	Monounsaturated	Polyunsaturated	
Human Milk (Colostrum)	44	44	12	310
Human Milk (Mature)	46	41	13	160
Palm Oil	50	39	11	16-20
Soybean Oil	16	24	60	29
Peanut oil	18	49	33	24
Sunflower Oil	11	20	69	14
Canola Oil	7	65	28	53
Olive Oil	14	75	11	0.5-2
Coconut Oil	96	4	-	14

Sources: Behrman and Gopalan (2005); Gebhardt et al. (2008); Park and Haenlein (2008)

Hypothetically, if one were to consume human breast milk at the same volume as palm oil, one's blood stream would have four times more palmitic acid.

In more affluent European countries *e.g.* Norway and Germany, there was no positive relationship between increased saturated fat consumption and CVD (*Figure 1*, blue trend line).

Table 2: Fatty Acid Composition of Palm Oil and Human Breast Milk.

Type of Fatty Acid (FA)	FA Composition	FA Carbon Chain	Human Breast Milk (HBM)	Palm Oil (PO)	(FA on sn-2 position/ total FA) ×100	
					HBM	PO
Saturated Fatty Acid (SFA)	Caproic	6:0	0	0	N/A	
	Caprylic	8:0	0.2	0	N/A	
	Capric	10:0	1.6	0	0.1	N/A
	Lauric	12:0	6.3	0.2	1.6	
	Myristic	14:0	6.0	1.1	3.2	
	Palmitic	16:0	19.5	44	17.4	4.9
	Stearic	18:0	6.3	4.5	0.6	0.1
	Arachidic	20:0	0.2	0.4	0.04	N/A
Monounsaturated Fatty Acid (MUFA)	Palmitoleic	16:1	2.2	0.1	0.6	
	Oleic	18:1	36.4	39.2	4.7	25.4
Polyunsaturated Fatty Acid (PUFA)	Linoleic	18:2	16.7	10.1	3.7	2.3
	Linolenic	18:3	0.8	0.4	0.2	N/A
Other Fatty Acids			3.8	0	N/A	
		Total	100	100		

N/A denotes values are unavailable. Sources: Fattore and Fanelli (2013); Lopez-Lopez et al. (2002); May and Nesaretnam (2014)

The complex relationship between saturated fat in human diet and CVD is further exemplified by a 2015 Credit Suisse AG report on "Fat: The New Health Paradigm" (Natella and Giraldo, 2015) where they showed that the consumption of diet with higher saturated fat by Europeans living in poorer European countries *e.g.* Bulgaria and Slovenia decreased the incidences of CVD in both men and women (*Figure 1*, red trend line).

Another interesting relationship is the strong, negative non-linear correlation between saturated fat concentration in vegetable oils and plant cholesterol (*Figure 2*). For instance, vegetable oils with high contents of polyunsaturated fat would also have high contents of cholesterol. Therefore, consuming vegetable oils with high unsaturated fats *e.g.* soybean oil suggests that we will inevitably be consuming higher plant cholesterol. Would this be

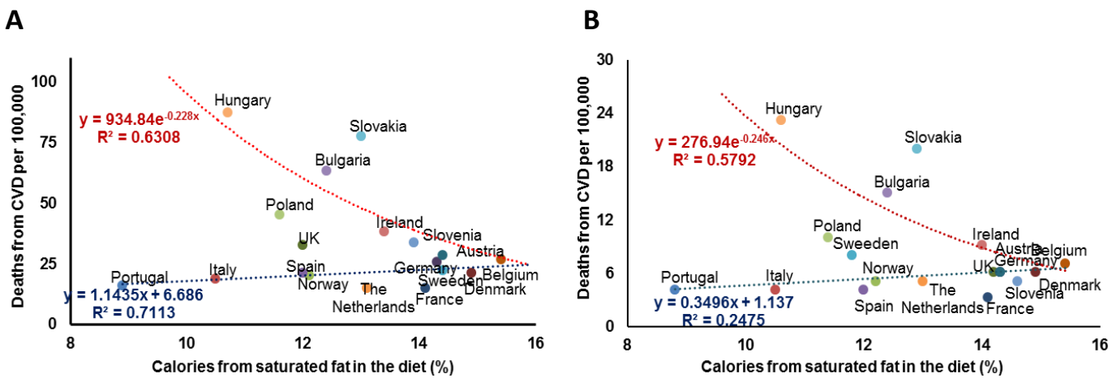

Figure 1: Effect of saturated fat in the diet of Europeans on the incidences of cardiovascular disease (CVD) by country for (A) men and (B) women. Source: Natella and Giraldo (*2015)*

beneficial or a risk to human health?

This brief article illustrates the irony of painting palm oil in a bad light by NGOs when it is the only vegetable oil with fat composition similar to human breast milk. More importantly, the "lipid theory" that was conceptualized from a few studies should be re-examined because they tended to emphasize statements such as, "*Diet with high saturated fatty acid (SFA) content caused an increase in serum cholesterol which increased the risk of cardiovascular disease*" (Fattore and Fanelli, 2013) without direct, scientific evidences. In a nutshell, vegetable oils with high palmitic acid content are not necessarily detrimental to us because if proven true, should we then stop feeding infants with human breast milk? Well, we started this article with the contention that "Mothers have no qualms or reservations feeding their child with breast milk" and will leave you with the idiom, "Mothers know best".

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Acknowledgement

The authors would like to express their gratitude to the Principals of Applied Agricultural Resources Sdn. Bhd., Kuala Lumpur Kepong Bhd. and Boustead Plantations Bhd. for permission to publish this article. We would also like to thank Dr Goh You Keng, Mr Patrick Ng, Miss Goh Chai Yeen, Madam Lily Loo and Madam Julie Yee for their useful comments in the preparation of this article.

This article has recently been accepted for publication in The Planter.

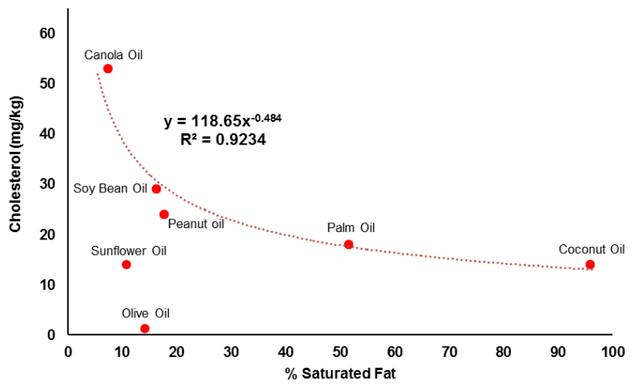

Figure 2: Correlation between cholesterol and % saturated fat of different plant oils. Sources: Behrman and Gopalan (2005); Gebhardt et al. (2008); Park and Haenlein (2008)
Note: The relationship shown in graph does not include data from olive oil and sunflower oil.