Sustainable Palm Oil

TECHNICAL UPDATE | JULY 2019

Sustainability is a key concern for everyone working in food production. Agriculture faces the challenge of increasing food production to efficiently supply the demands of the growing population, while reducing resource use and addressing consumer demands and concerns for the environment.

Palm oil production

According to the United States Department of Agriculture (USDA), approximately 65 million metric tonnes (MMT) of palm oil is currently being produced in the world per year, with 85% of this coming from Malaysia and Indonesia. Its usage (according to the USDA) is broken down roughly as follows:

- **69% food i.e. margarines, processed food, bread, chocolate etc.**
- **20% cleaning and personal care i.e. cosmetics, detergents, candles etc.**
- **10% energy i.e. biodiesel, electricity, heating etc.**
- **1% in agriculture**

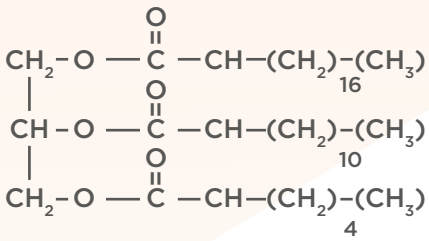
The amount of palm oil used for biodiesel is on the decline. The reason why palm oil is used in so many food products is that it is a versatile hard fat, which is chemically stable and does not oxidise or go rancid very easily. It is also relatively cheap on the world market because palm trees are so high yielding per hectare of land when compared with other vegetable fats.

Why feed Palm fat to cows?

Palm fat is sometimes fed to cows as it can help to improve milk quality. Legally milk must contain 3.5% butterfat but most milk buyers ask their suppliers to produce milk containing a minimum of 3.8% butterfat and some milk buyers reward farmers for higher constituents. Where milk butterfat falls below the minimum standards, or where the farmer is incurring significant financial penalties, then the farmer may resort to feeding palm fat to their cows. This, however, is not generally their first choice to improve milk butterfat levels, as palm fats are very expensive and are of marginal economic benefit.

To understand how milk fat can be manipulated it helps to know a little bit about its composition. Milk butterfat is made up of individual fatty acids molecules which can have between 4 and 25 carbon atoms, attached to glycerol, a 3-carbon backbone.

Figure 1. Triglyceride



Approximately 18 fatty acids make up 90% of milk fat but there are about 66 different fatty acids which can attach to the 3-carbon glycerol in different combinations to form many different triglycerides or fats. Consequently, milk fat has the most complex fatty acid composition of the edible fats, with over 400 individual fatty acids performing functions which have yet to be fully understood.

Table 1. Fatty acid composition of cow's milk at grass (Morrison 1970)

Fatty acid	%	Range, %
C 4:0	4.0	2-5
C6:0, C8:0, C10:0, C12:0, C12:1, C14:0, C14:1	18.9	15-27
C16:0 & C16:1	30.0	25-55
C18:0	13.0	2-16
C18:1	30.8	na
C18:2 & C18:3	3.3	na
Key: na - not available		

The short chain fatty acids, from C4:0 to C14:1, which make up 23% of milk fat, arise from de novo synthesis in the mammary gland. The long chain fats, from C18:0 to C24:0, tend to be

derived from the diet and are transported to the mammary gland. The palmitic C16:0 and isomers of C16:1 arise naturally from its synthesis in the mammary gland, and from background levels of palmitic acid supplied in grass and the diet.

Milk butterfat production

Milk butterfat production is governed by a number of factors that include the diet; the type, quantity and quality of the forage fed; stage of lactation; milk yield; time of year; breed of cow; genetics and management. Where milk butter fats are low, and to avoid financial penalties, the priority is to identify where the problem lies. In most cases the diet is the easiest factor to manipulate to increase milk butterfat.

Normally, about half of the milk fat produced is synthesised from digestible dietary fibre (via its fermentation in the rumen to acetic acid), while the remaining half, as already indicated, is derived from the diet and background oil in the forages and other ingredients fed; which might include supplementary fat.

In order to maximise milk butterfat production it is important that:

1. The diet contains sufficient digestible fibre

2. The rumen environment is stable, not too acidic, and favours the fermentation of digestible fibre to acetic acid as opposed to lactic acid.

3. The diet does not contain too much unsaturated fat, particularly linoleic acid (C18:2) as this can be broken down under acidic conditions to an isomer called trans-10, cis 12 CLA, which can depress the natural synthesis of milk butterfat.

Based on experimental work, as little as 10g of the trans-10, cis 12 isomer, derived from linoleic acid, can reduce milk butterfat production by half, from 4% to 2%. Therefore unsaturated oils, which contain a high proportion of linoleic acid, should be avoided in milking cow diets.

Why is Palm Oil so good nutritionally for the cow?

The following table shows how palm oil is high in palmitic acid (C16:0) and low in the linoleic fatty acid that has the potential to suppress natural butterfat synthesis; whereas soya oil, sunflower, maize, rape and linseed oil are all low in C16:0, and high in linoleic acid, making them unsuitable.

Palmitic acid, whether provided by grass and other forages/feed, or when added to the diet, can be used by the cow to increase the efficiency of milk production, because:

1. Dietary fat is so energy dense compared to other nutrients such as starch, sugar, fibre and protein. This applies not only to palm oil but other oils and fats in the diet too.

2. Dietary palmitic acid has a sparing effect on the synthesis of C16:0 in the udder by the cow.

3. Palmitic acid is biochemically versatile and can be broken to shorter chain fatty acid, and it can be synthesised up to longer chain fats forming the building blocks of metabolites such as progesterone.

Feeding around 200-250g of palmitic acid per head per day to a dairy cow can increase milk butterfat by around 0.15-0.2%, but

Table2. Average fatty acid make up (% of total fatty acids) of different oils (Hecke E A, 2009 SFR table)

Fatty acid abbreviation and name		Palm oil	Soya, sunflower & maize oil	Rapeseed oil	Linseed oil
C12:0	Lauric	6	-	-	-
C14:0	Myristic	6	-	-	-
C16:0	Palmitic	38	11	5	7
C18:0	Stearic	4	4	2	4
C18:1	Oleic	37	22	56	18
C18:2	Linoleic	10	54	22	16
C18:3	Linolenic	2	8	9	54

its use is limited because it is expensive and there are other more cost effective ways of increasing milk butterfat.

There are other saturated oils, such as coconut oil and tallow, which could help with milk butterfat synthesis but while tallow is permitted in the USA, it is banned in Europe, and coconut oil is not very stable.

Environmental issues

There are serious environmental issues involved with palm production and the deforestation of tropical rain forest. Much damage has been done with the loss of carbon, destruction of forests absorbing carbon from the atmosphere, damage to ecosystems and the displacement of local villagers and animals. However, despite this, Environmental Correspondent Erik Meijaard, from the Guardian Newspaper, in his tweet believes that palm production is not the environmentalist's greatest concern and that its production is preferable to a vast expansion in soya plantings, if palm was ever banned.

By way of an explanation, the following table provides a graphical representation of the oil yields of some of the mainstream crops. From this it can be seen that palm is between five and 10 times more productive in terms of yield of oil, compared with other crops.

This graph does not take into account the energy and value of the high protein meal produced by soya, sunflower and rape and how this compares with palm kernel meal, but in energy terms, palm is a very productive crop. If it was not used for edible oil then a much greater area of land would be taken out by the other vegetable crops to make up palm production.

In total, about 6% of the world land area is used to grow palm and this accounts for around 40% of total global vegetable oil production.

What is clear, though, is that more should be done to implement due diligence and traceability to accept only responsibly-sourced palm oil, free from deforestation. This is why the Roundtable on Sustainable Palm Oil (RSPO) has been set to help reform the palm oil industry, promote transparency, fair labour, and strict environmental standards.

There are still a number of problems implementing and regulating the RSPO standards. Some corporations have not joined. Only around 35% of palm growers that are members of the RSPO are actually certified, but as awareness to the problems of palm production increases, hopefully this will be rectified.

In Malaysia, much of the rain forest is now protected and Indonesia is starting to curb their expansion of palm production. However, they have produced so much palm oil recently that it has caused the price to fall to its lowest levels since 2009 which then makes palm more attractive for industrial use.

Below are tables showing Indonesian and Malaysian palm oil production and export figures. Between them, these countries represent 85% of world palm production, and 90% of world exports.

Table 3. Oil yields from mainstream crops

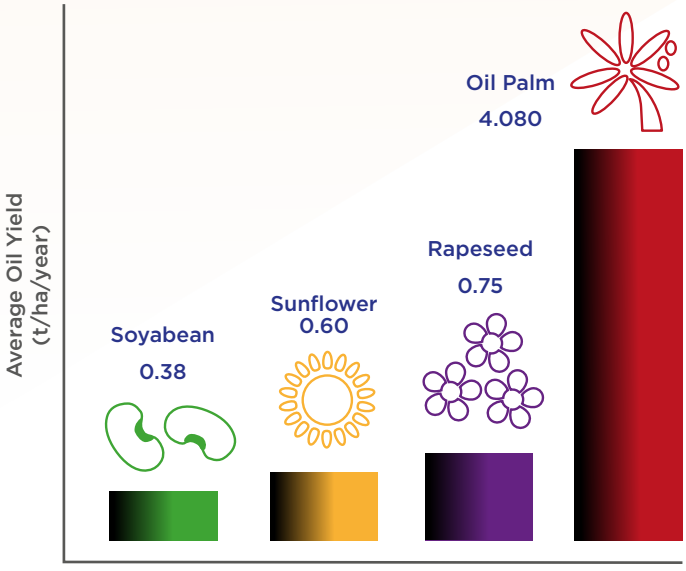
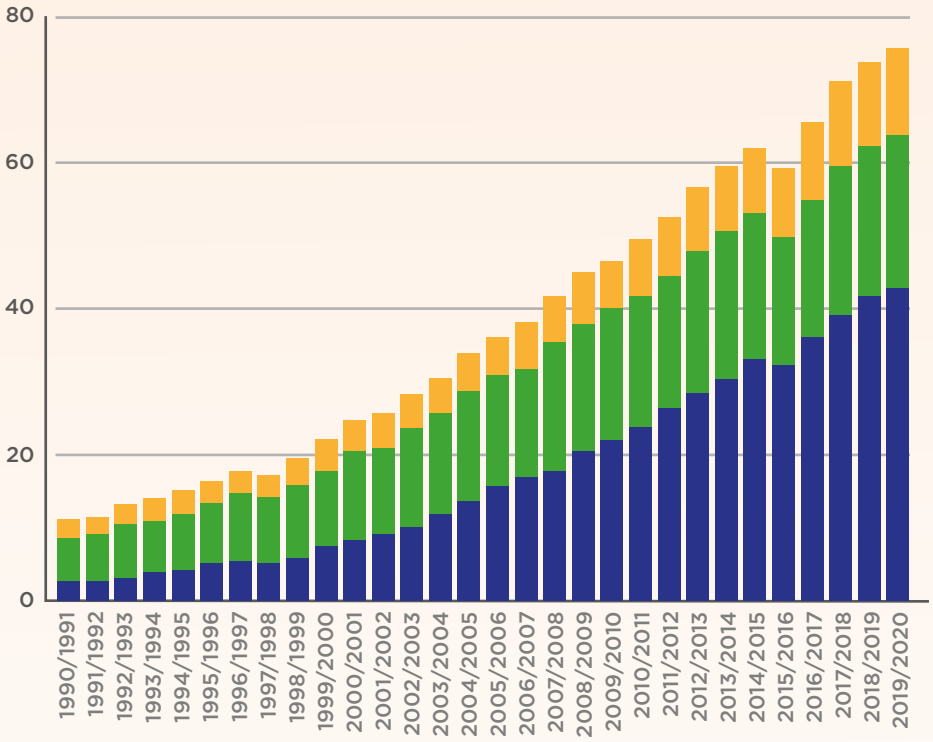


Table 4. World palm production, data from CRM Agri Commodities



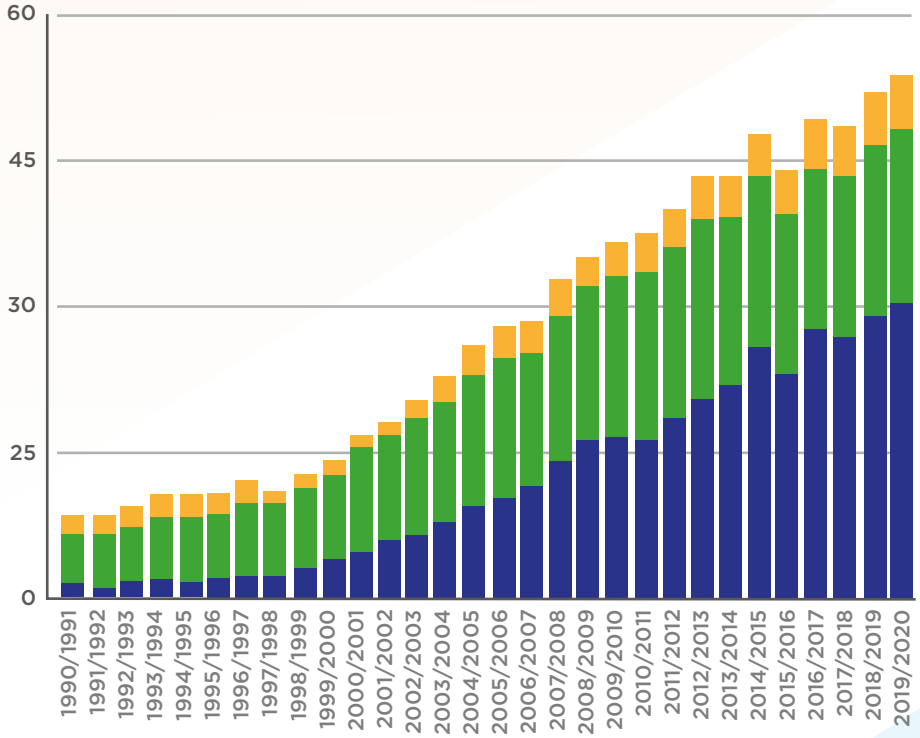
INDONESIA + MALAYSIA = 85% OF WORLD PRODUCTION

Indonesia

Malaysia

Rest of the world

Table 5. World palm global exports, data from CRM Agri Commodities



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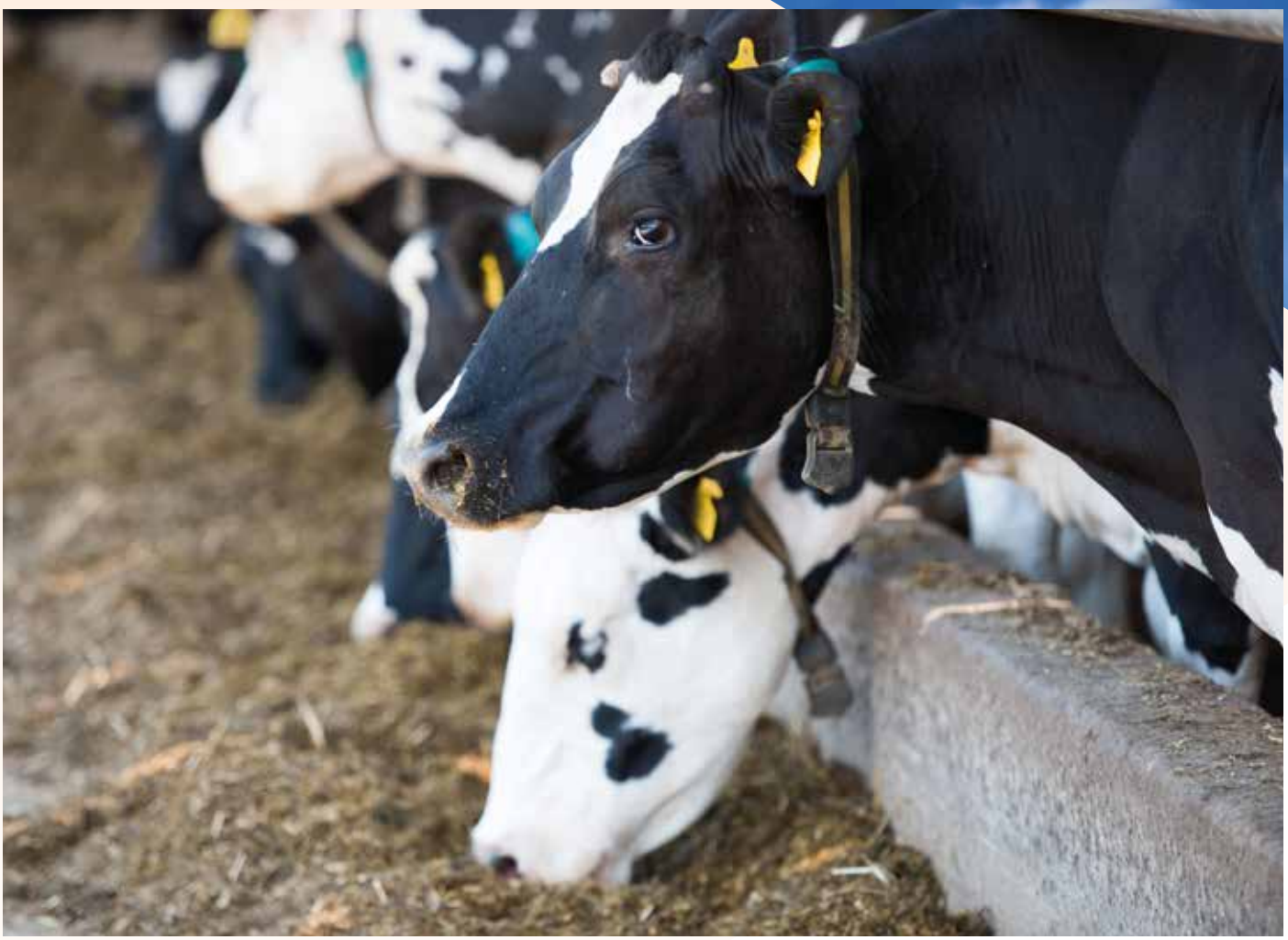


Roundtable on Sustainable Palm Oil (RSPO)

The RSPO (Roundtable on sustainable Palm Oil) is a member organisation that oversees the production and global use of sustainably produced palm oil. The definition of sustainability (known as Principles and Criteria) are determined, implemented and audited by the RSPO.

There is no similar scheme to the RSPO for palm kernel. Large quantities of palm kernel are produced as a by-product of palm oil produced for human food, personal care and fuel, resulting in large quantities of kernel being left to rot, or burnt in power stations, or used as a soil conditioner.

Palm kernel is viewed by the UK Agricultural Industries Confederation (AIC) and the European Feed Manufacturers Federation (FEFAC), in conjunction with government round table discussions (including DEFRA), as a by-product which does not require separate certification, as it is the oil which drives the production of palm, not palm kernel.

To trade certified sustainable palm oil you need to be a member of the RSPO (membership fee 2,000 Euro per year or 100 Euro per year if using less than 500MT a year). It is important to note that membership of the RSPO does not mean product supplied is sustainable. This is a common misconception. A supplier waving a RSPO membership certificate is meaningless without certified sustainable product, which is determined by the provision of Palm Trace Sustainability Certificates. These certificates are currently trading at 5 US$ per tonne including fees. The certificates purchased need to be kept and filed to support any claims made during the annual audit.

RSPO members are audited annually to cover a calendar year (Jan – Dec) and have until March the following year to purchase all the certificates needed to cover the claims made during the previous calendar year.

For more info see https://rspo.org/palmtrace#whichproduct

Sourcing palm oil and oils containing palm oil

Palm-based high C16 fats, and calcium soap fats, either as 'straights' or as an ingredient in the dairy compound feeds fed, need to be sourced from an RSPO-approved supplier.

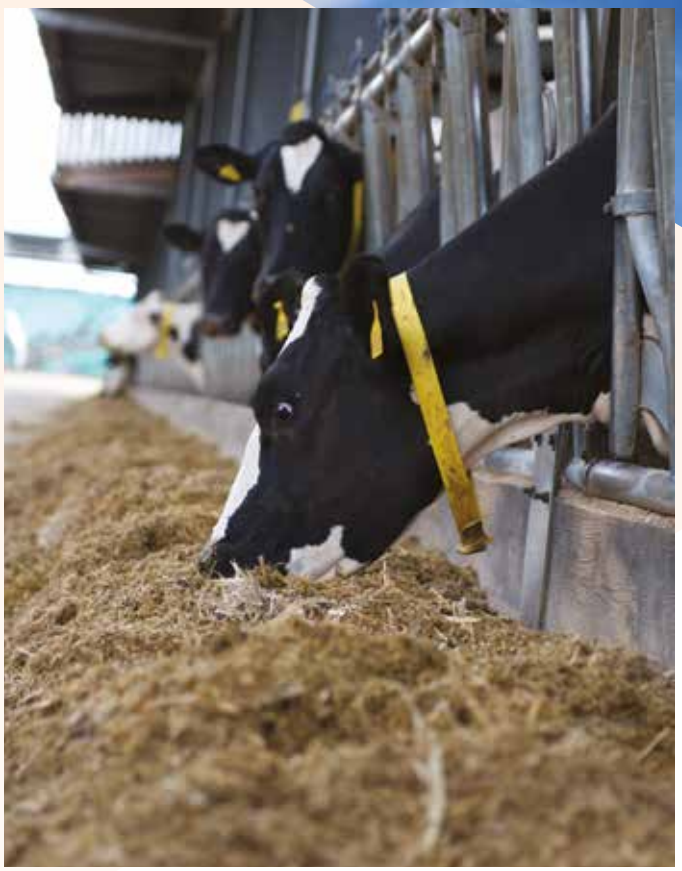
This means the farmer needs to know what palm-based ingredients are contained in their dairy compound feed and the level of inclusion.

To ensure full traceability for on farm audits by the milk buyer, the feed supplier needs to provide the farmer member with:

- A warranty letter guaranteeing their RSPO status; stating their RSPO membership number and origin of product.
- Documentation showing the quantity of palm trace certificates purchased to cover the quantity of product purchased.

In addition, the supplier delivery documents should include their RSPO membership number so this can be viewed and checked when product is delivered on farm.

Farmers who struggle to find an RSPO member to supply their C16 fats, or calcium soap fat could, if they wished, contact Kite Consulting's sister company called 'Advance Sourcing'. Advance Sourcing works with a number of trusted suppliers to deliver high quality technically-sound products at competitive prices and are able to help source RSPO-approved palm fat products. Advance Sourcing can be contacted on 01823 491238.



Summary

Palm oil supplements would be difficult to replace. They are a good source of palmitic acid (C16:0), which can maintain milk butterfat content when other factors are stressed.

It is clear that consumer organisations should be doing more to implement rigid due diligence and traceability to accept only responsibly sourced palm oil, free from deforestation.

RSPO-approved suppliers are now in a position to provide both a High C16 and a Calcium Soap-based product on the basis that the process outlined meets the milk buyer's approval.

For enquiries regarding the information in this Technical Update please contact:
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