2nd POTS
INTERNATIONAL PALM OIL TRADE FAIR & SEMINAR 2008

Changing Marketing Landscape - Challenges for Business Sustainability

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THE MARCH OF GMO OILSEEDS - POSITIONING PALM OIL

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SESSION 2

POLICIES & REGULATIONS: ISSUES INFLUENCING THE OILS & FATS DYNAMICS

The March of GMO Oilseeds - Positioning Palm Oil

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Abstract

Planting of genetically modified (GM) agricultural crops including oilseeds has registered impressive growth rates during the past decade and is currently estimated at nearly 115 million hectares of planted area. Nearly 23 countries actively encourage cultivation of GM crops backed by a proven high adoption rate among farmers and belly the fact that GM crops can deliver significant economic benefits. The United States retains its position as the global leader accounting for nearly 50% of global biotech planted area spurred by GM maize (for ethanol production), soyabean and cotton. Argentina, the second largest GM cultivator dedicates nearly 16 million hectares for GM soyabeans which is more than 50% of the global total GM soya planting of 25.8 million hectares. GM Canola planting is estimated at 5.5 million hectares.

In GM oilseeds, apart from trait improvements such as herbicide tolerance, insect and virus resistance, modification in the fatty acid composition is an important target. In the post trans era this has taken on greater urgency to fill the void for solid fats that were traditionally made with partially hydrogenated fats. Soya and canola varieties genetically modified for higher saturates, primarily as stearic are in the pipeline buoyed by a strong move to label stearic acid as a neutral saturate with respect to its cholesterolaemic response. However, the road towards such nutritional labeling is still subject to scientific scrutiny since high stearic diets have been shown deleterious in some studies. To a lesser degree, the introduction of lauric, (primarily for oleochemicals) and palmitic have also been initiated. A more successful fatty acid modification trait has been towards high monounsaturated content, achieved by significant reductions in the original polyunsaturated content in oilseeds. These high-MONO cultivars from soya, canola and cottonseed impart higher heat stability especially during deep frying of foods and are finding demands from fast food franchises looking out for nutritionally superior frying fats to replace trans-frying shortenings. Full availability is however not anticipated until after 2011 since there is limited supply of the oil. New oil varieties do not always provide a glove fit for functionality and customer satisfaction and prices of these varieties are also much higher. Palm oil continues to qualify as non-GM edible oil even as its biotechnology research is highly geared. GM enhanced traits for palm oil in the future include higher oleate and stearate content and separate insertions that will enable the oil palm tree to produce bioplastics, lycopene and improve fungal resistance. Meanwhile palm oil currently available competes head-on with GM oilseeds since many desired compositional and functional characteristics can be achieved simply by existing process modification technologies at costs significantly lower than the GM oils.

The March of Genetically Modified (GM) Oilseeds – Positioning Palm Oil

MPOC

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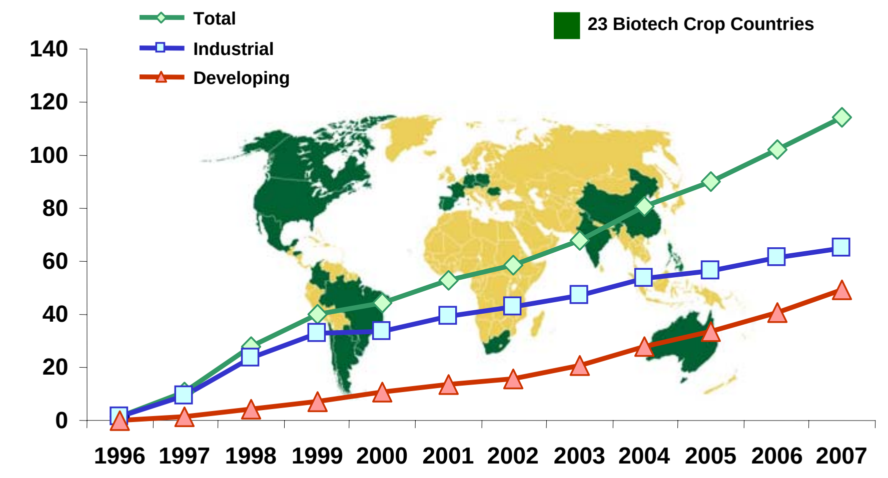
FDA'S Labeling Guidelines

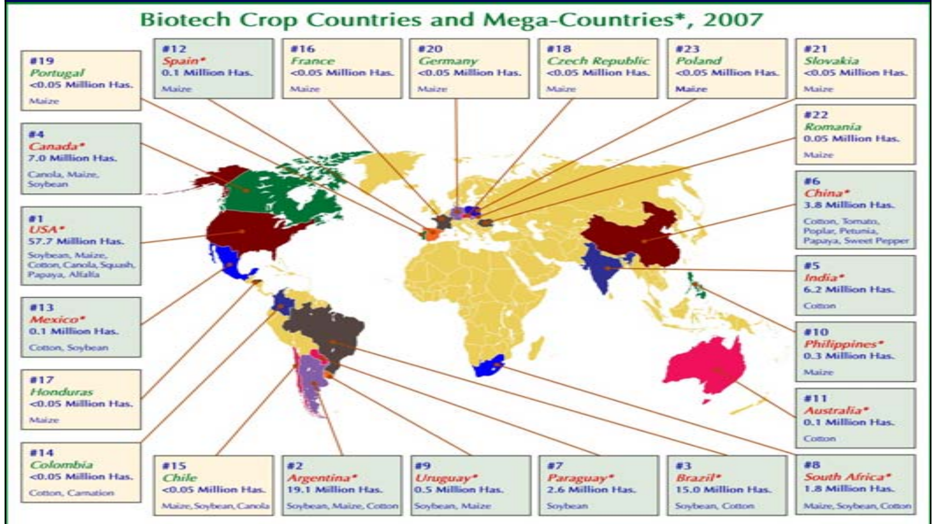
- Food derived from new crops (GM included) that differs in composition, nutritional profile, safety must be specially labeled
- If new crops are equivalent in composition, nutritional profile, safety – not required for special labeling



Increase of 12%, 12.3 million hectares (30 million acres), between 2006 and 2007.

Source: Clive James, 2007.

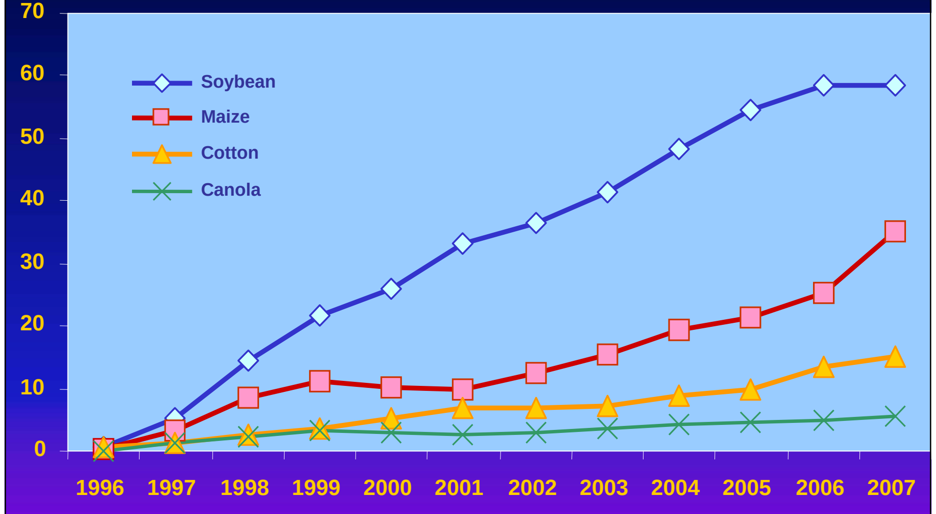
Biotech Crop Countries and Mega-Countries, 2007



* 13 biotech mega-countries growing 50,000 hectares, or more, of biotech crops.

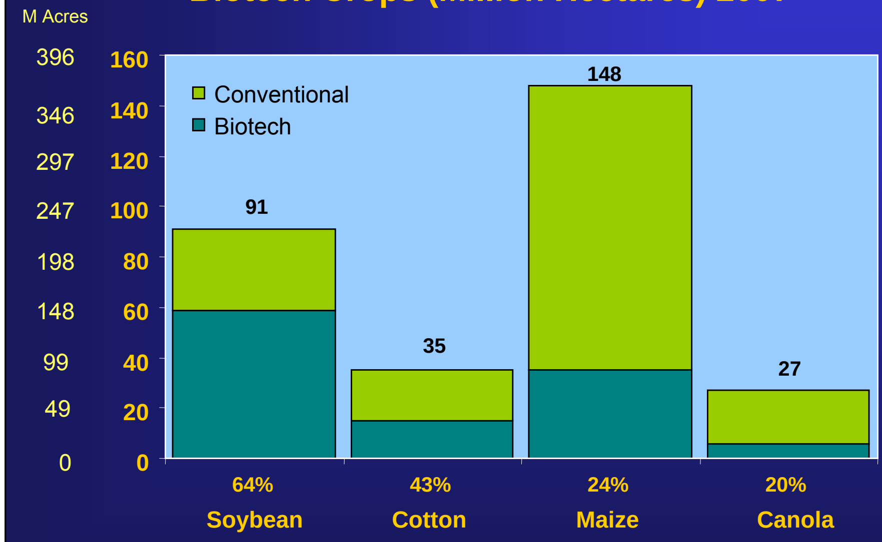
Source: Clive James, 2007

Global Area of Biotech Crops By Crop (Million Hectares)



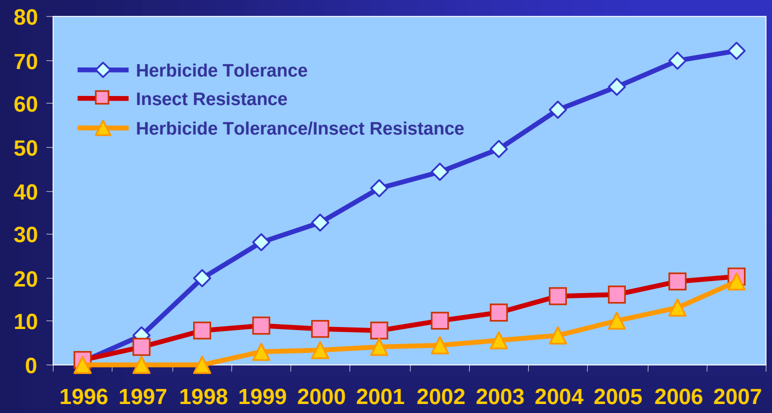
ISAAA, 2008

Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares) 2007



Source: Clive James, 2008

Global Area of Biotech Crops, 1996 to 2007: By Trait (Million Hectares)



Source: Clive James, 2008

GM Soy Targets Changes in FAC To Meet Post-Trans Era Needs

	Oleic	Linoleic	Linolenic	Total Sats
High-Oleic	80%	3%	3%	12%
Low-Linolenic	25%	56%	3%	15%
Commodity	23%	50%	7%	15%

- **Fatty acid content of various soybean oil varieties**

Modification of FAC by Plant Breeding or Genetic Engineering for Mid and High Oleic Varieties

Product	Applications	FAC (%) TFA	SFA	PUFA	MUFA
Clear Valley / Odyssey Canola	High stability frying oil, baking, blending	<1.5	6	12-25	65-75
NuSun Sunflower	Industrial frying, baking, high Vitamin E	tr	9	26	65
Natreon Canola	Industrial frying, baking, blending	<1	7	18	74
Natreon High Oleic Sunflower	High stability frying, baking, blending	<1	10	7	>80
TriSun High Oleic Sunflower	High stability, baking, spray coating	tr	8	9	>81

Fatty Acid Composition of Various Edible Oil Seeds and Genetic Variants

Fatty Acid Composition (g/100g)

Variety	16:0	18:0	18:1	18:2	18:3
Soybean					
Traditional	11	4	23	54	8
Low Linolenic	10-15	5-6	32-41	41-45	2
High Palmitic	25	4	16	44	10
High Stearic	9	26	18	39	8
High Oleic	8	3	84	3	1
Low Palmitic	4	3	25	58	8

Fatty Acid Composition of Various Edible Oil Seeds and Genetic Variants

Fatty Acid Composition (g/100g)

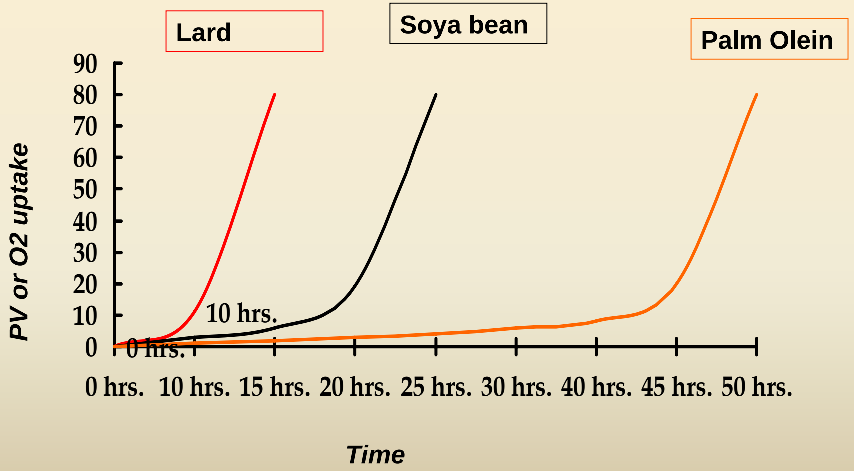
Variety	16:0	18:0	18:1	18:2	18:3
Canola					
Traditional	4	2	62	22	10
High Oleic/Low Linolenic	4	2	89	2	3

Fatty Acids of Various Edible Oil Seeds and Genetic Variants

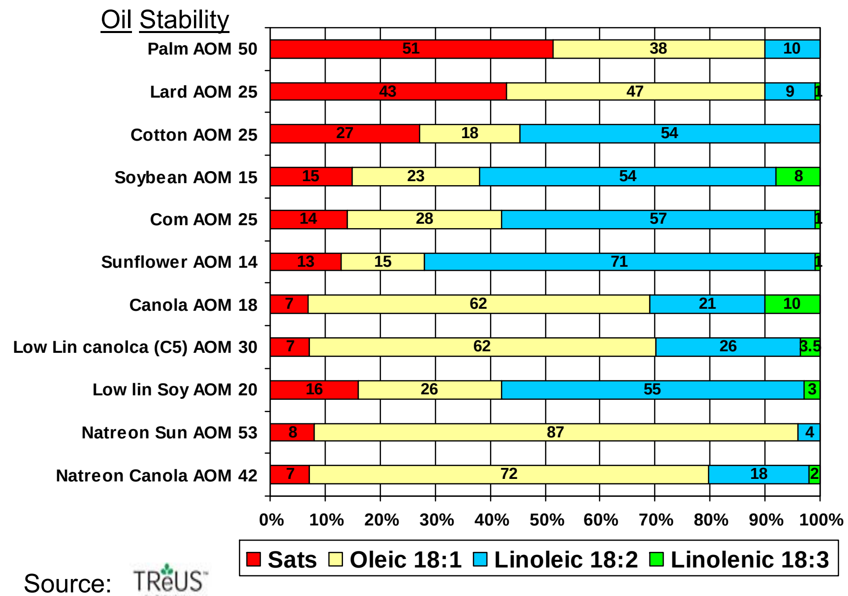
Fatty Acid Composition (g/100g)

Variety	16:0	18:0	18:1	18:2	18:3
Sunflower					
Traditional	7	4-6	20-30	60-70	<1
High Oleic	5	4-5	80-90	5-9	<1
Mid Oleic	4-5	4-5	55-75	15-35	<1

OXIDATIVE STABILITY of Oils

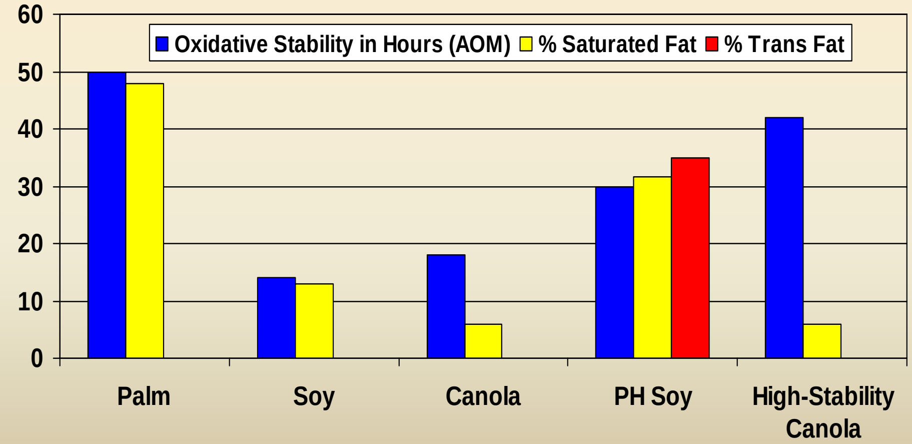


Fatty Acid Profile & Oxidative Stability



Source: TReUS

High Oxidative Stability Is Also Associated with Good Nutrition In Fried Products



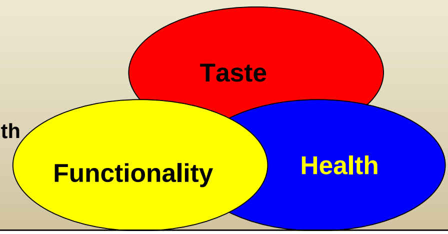
Source: TReUS

Fatty Acid Composition Dictates Functionality

Oil	*OSI (110C) Stability Index*	*Oleic C18:1*	*Linoleic C18:2*	*Linolenic C18:3*	*Total Sats*	*Total Trans*
High Oleic Sunflower	18.5 hrs	86.5 %	5.1%	0.2%	7.6%	1.0%
High Oleic Canola	16.8	73.0	71.2	2.1	7.1	1.0
Low Linolenic Canola	8.3	62.1	25.3	3.2	7.4	1.0
Low Linolenic Soy	8.1	17.4	53.6	2.7	15.6	1.0
Partially Hydrogenated Soy	11.6	41.4	23.6	2.1	15.6	16.3
Soybean	7.1	21.5	54.2	8.6	15.5	2.1
Palm Olein	17.1	47.0	13.0	1.5	36.0	1.0

PALM OLEIN:

- Long fry life – cost effective
- Trans fat free
- Fits Functionality, sensory & health
- Available now / supply assured

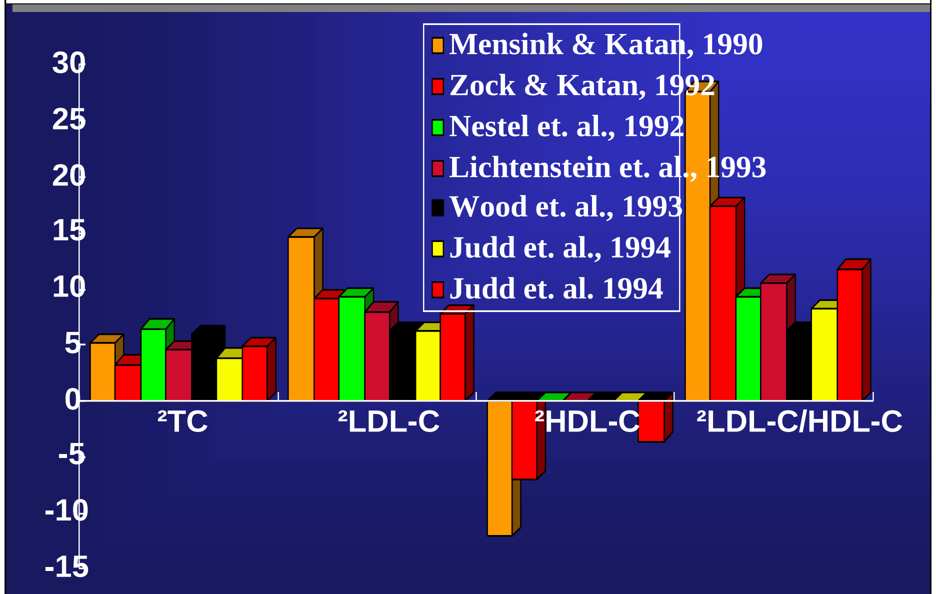


Adapted from: TReUS

Typical Characteristics of Palm Based Frying Oil

- *More resistance to breakdown as compare to soft oils*
- *Bland taste (Carries the flavor of the food)*
- *Less foaming, less oil absorption & less volatile compound formed*
- *Impart longer keeping quality/shelf life of fried food*
- *Suitable as blend with other oils*

Trans is Deleterious to Health: Summary of the human data



Process Innovations Towards Trans Free Formulations

Product	Description	Applications
IE Novalipid	Fully Hyd SBO, cottonseed oil IE with native SBO for hard fats	Bakery Products
Benefat Salatrim	Low energy TG blend by IE of short chain FA and C18: 0 from hyd fat	Reduced calorie baked products, confectionery biscuit fillings
Enova	Edible oil with 80% DAG from IE SBO/Canola	Baking, grilling, frying, salads
Neobee MCT	MCT shortening	Nutritional products, baking, confectionery, margarine
Neobee MLT-B	Shortening from IE MCT, tristearic and fully hyd SBO	Baking, margarine, coating fats, salad oils

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Stearic acid-rich interesterified fat and trans-rich fat raise the LDL/HDL ratio and plasma glucose relative to palm olein in humans

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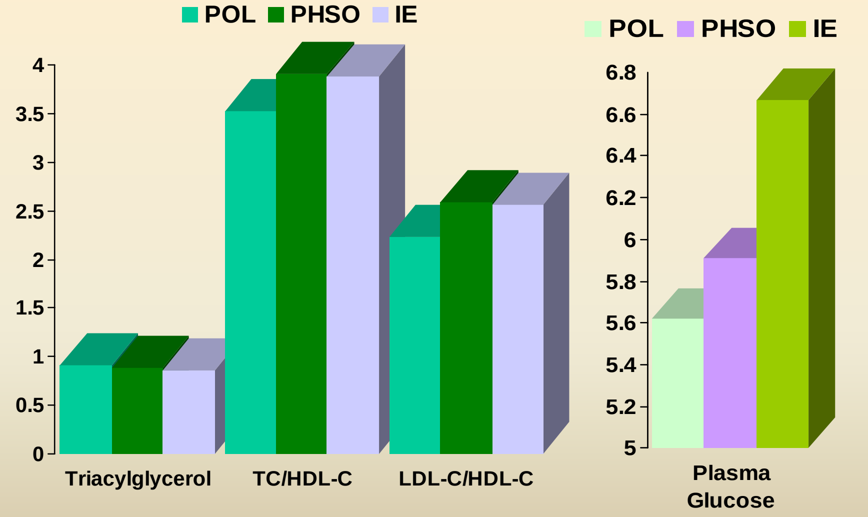
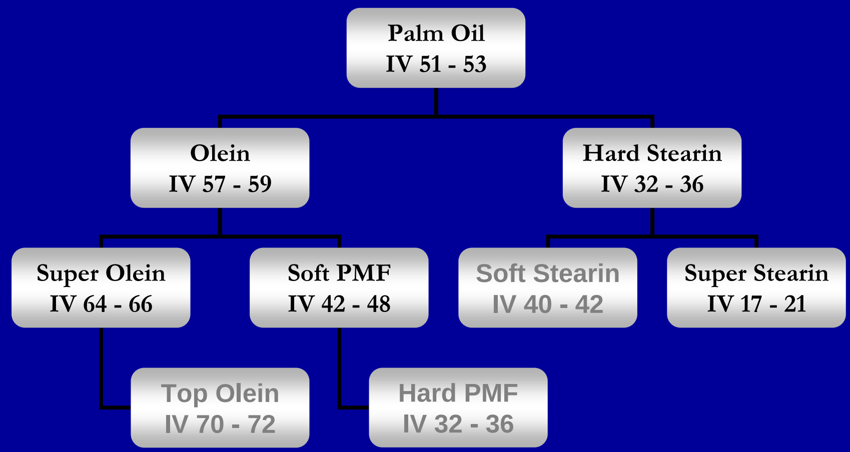
Fully Hydrogenated IE Stearic-Rich Fat Elevates Plasma Lipids and Glucose in Humans



Sundram et al. Nutr. & Metabolism, 2007

Palm Oil Fractions With Different Iodine Value Ranges For Foods



The Palm Factory

TARGETED PRODUCTS

(Genetically engineered)

- ❖ High oleic acid oil √
- ❖ High stearic acid oil √
- ❖ Biodegradable plastics √
- ❖ Lycopene-enriched oil
- ❖ High palmitoleic acid oil
- ❖ High ricinoleic acid oil
- ❖ Fungal-resistant palms √

S. Ravigadevi et al. , 2008 (MPOB)

HIGH OLEATE PALM

- ❖ Source of oleic acid for oleochemical industry
- ❖ Reduced processing cost for near homogenous material
- ❖ Entry into liquid oil market

S. Ravigadevi et al. , 2008 (MPOB)

FATTY ACID PROFILES

	Current	Target
❖Palmitic acid C16:0	44%	8 – 13%
❖Stearic acid C18:0	<5%	<5%
❖Oleic acid C18:1	39%	70 – 80%
❖Linoleic acid C18:2	10%	10%
❖Iodine value (IV)	55	72

S. Ravigadevi et al. , 2008 (MPOB)

Crop Improvement via Breeding

- ❖ Public acceptance, governmental regulations and ecological concerns of GM : Non-GM route
- ❖ GM oil palm not expected to be commercialized until 2050 (at least 2 breeding cycle)

PS1 – Low height increment PS2 – High iodine value PS3 – Thick mesocarp PS4 – High carotene content *(E. oleifera)* PS5 – Thin shell tenera PS6 – Large *dura* fruit	PS7 – High bunch index PS8 – High vitamin E content PS10 – Long stalk PS11 – High carotene content *(E. guineesis)* PS12 – High oleic acid

S. Ravigadevi et al. , 2008 (MPOB)

Manufacturing Food Ingredients
Supply Considerations

"Just two fats and oils dominate and dictate processing worldwide, and any discussion of strategies to reduce trans and saturated acids in the food supply must focus on soybean and palm oils."

- Gary R. List, Lead Scientist, Food and Industrial Oil Research, NCAUR, ARS, USDA, Peoria, IL.

» Food Technology **58**:23-31 (2004).

Thank You

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