PHO Removal

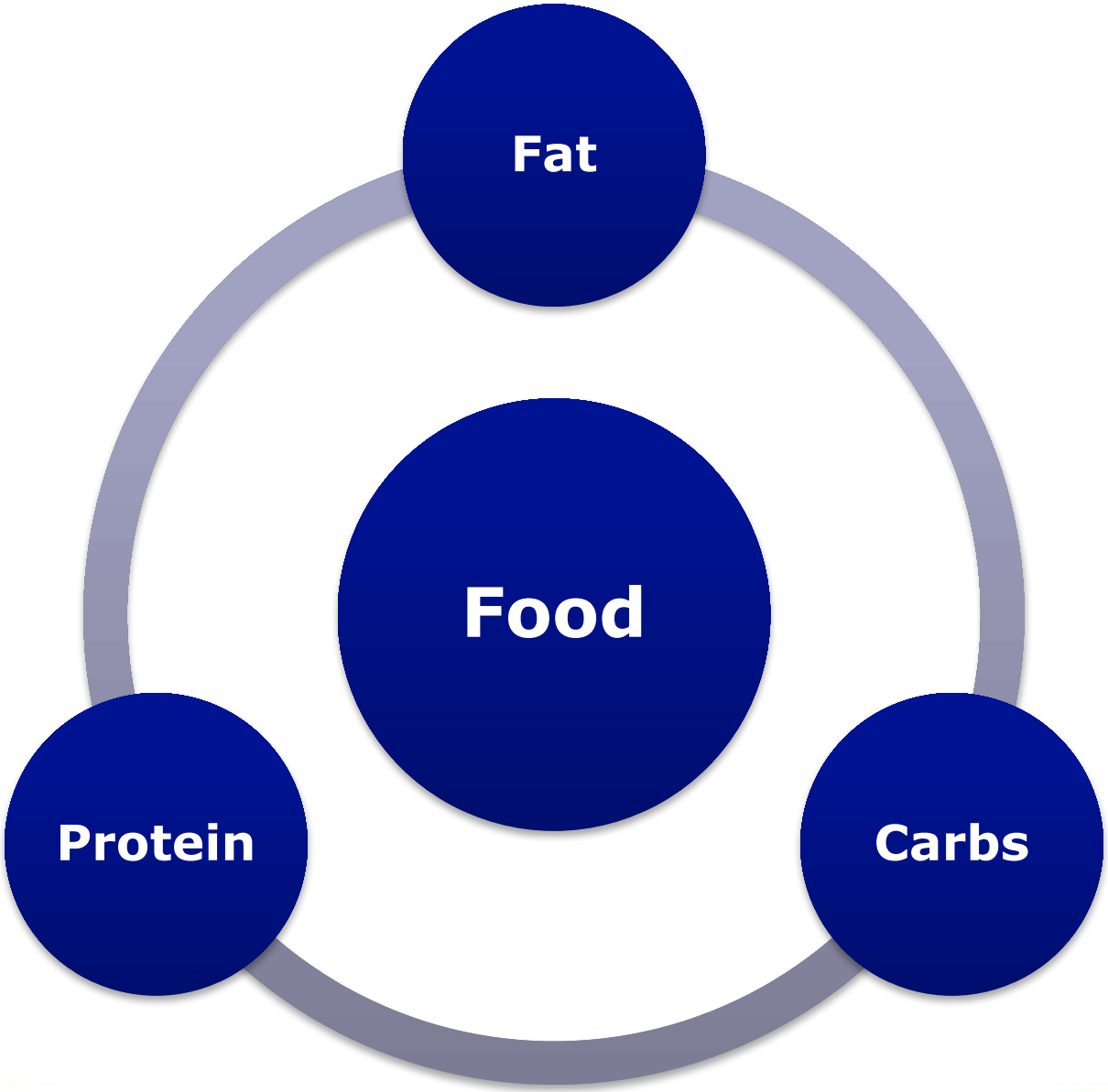
General Mills October 27 2015

Presented by Harold Kazier

IOI Loders Croklaan

Let's create together

IOI GROUP


Fat
Food
Protein
Carbs

Nutritional Aspects of Fats and Oils

- Essential Constituent of the Human Diet
- Major source of energy
  - Supplies 9 cal/gram
  - vs... 4 cal gram (Protein & Carbohydrates)
- Source of fat soluble vitamins and improves absorption of vitamins regardless of source
- Relationships of Dietary Fats and Oils with incidence of Heart and Vascular Disease

Fats and Oils

- Fat is a major component in food systems
- Success or failure is dependent upon:
  - Selection of an oil that is appropriate for each individual application
  - Specific requirements for:
    - Flavor/Flavor Release
    - Texture
    - Appearance
    - Shelf Life
    - Cost
    - Availability

Fats and Oils Use in Foods

- Selection Criteria:
  - Specific application
  - Nutritional implications
  - Religious dietary guidelines
    - Kosher
    - Hallal

How did we get Trans Fats?

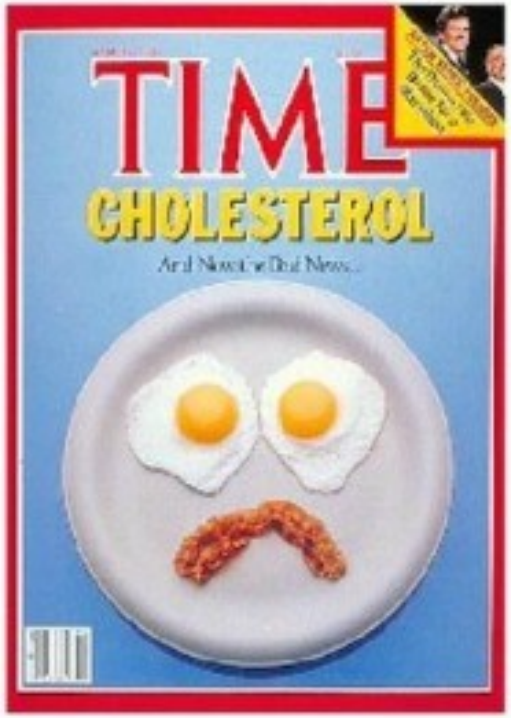
The Diet-Heart Paradigm

Prof. Ancel Keyes, 1961

"The U.S. diet is 40% fat, and most of that is saturated fat—the insidious kind… "

Total Fat Saturated Fat → **Serum Total and LDL Cholesterol** → **Coronary Artery Disease**

How did we get Trans Fats?



"Poisoning of America"
Phillip Sokoloff 1986

- Heart attack at age 43, blamed on saturated fats including coconut, palm, butter and tallow
- $15 million advertising campaign to reduce sat fat intake
- Joined by American Soybean Association
- Informal Senate Hearing

The Advent of Trans Fat?

1970s: ***Plant based vegetable oils***

- Cottonseed, Soybean and Rapeseed

Liquid oils suitable for frying, dressings, mayonnaise and more.

<u>But not baked goods! A solid fat is required.</u>

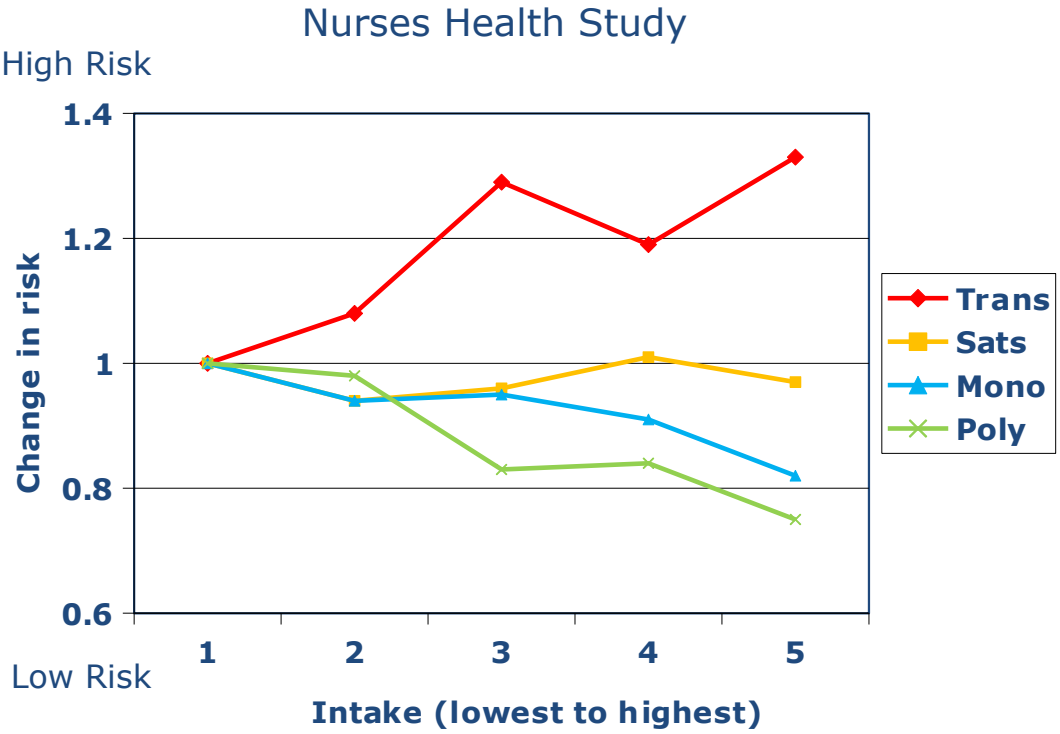
Solution:

Partially Hydrogenated Vegetable Oil (PHVO)
Converts a liquid oil to solid fat

- Resistant to oxidation;
- Lower saturated fat content;
- Similar texture to animal fat;
- Inexpensive
- Contain synthetic fatty acid called trans fat

Harmful Trans Fats

Saturated fat is not as bad as we once thought



FDA Bans PHO

- In 2006 FDA Introduced Mandatory Labeling of Trans Fats Content on Retail Food packaging.
- The U.S. Food and Drug Administration finalized and published its determination on June 17, 2015 that partially hydrogenated oils (PHOs), the primary dietary source of artificial trans-fat in processed foods, are not "generally recognized as safe" or GRAS for use in human food.

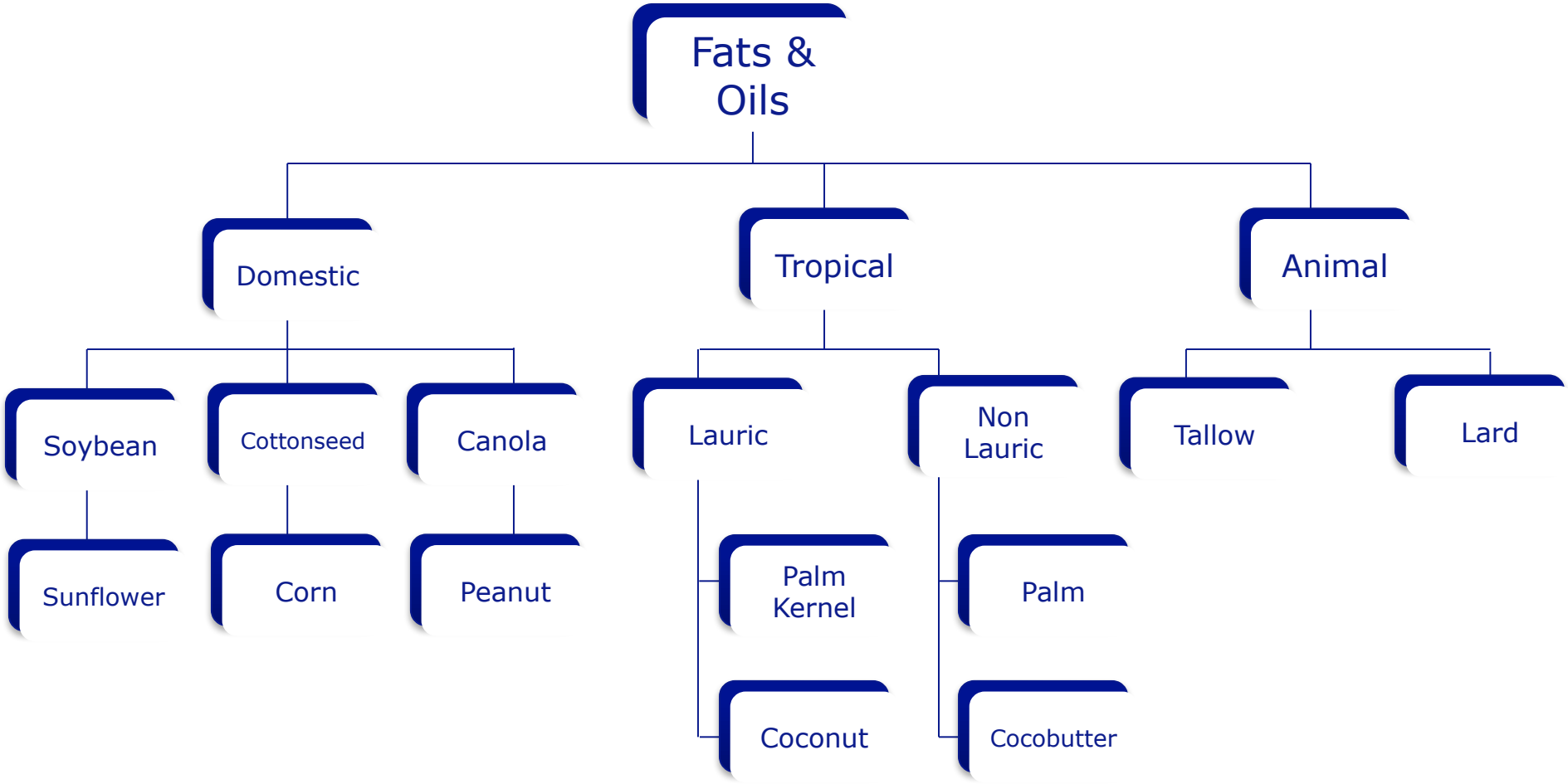
FDA Bans PHO

- FDA has defined PHO as those liquid fats and oils that have been hydrogenated but not to near completion and with an iodine value (IV) greater than 4.
- The FDA has also determined that Fully Hydrogenated Oil (FHO) contains less than 2% trans-fat, and the definition of FHO is near complete saturation with an iodine value (IV) value of 4 or less. The declaratory order is limited to PHOs only and does not affect FHOs.
- PHOs are not GRAS for use in any human foods.
- The FDA order specifies a compliance date of no later than June 18, 2018.
- Any interested party may seek food additive approval for one or more specific uses of PHOs, with data demonstrating a reasonable certainty of no harm of the proposed use. GRAS determination does not apply to naturally occurring trans-fat.
- The PHO ban applies only to food for human consumption and does not include animal feed.

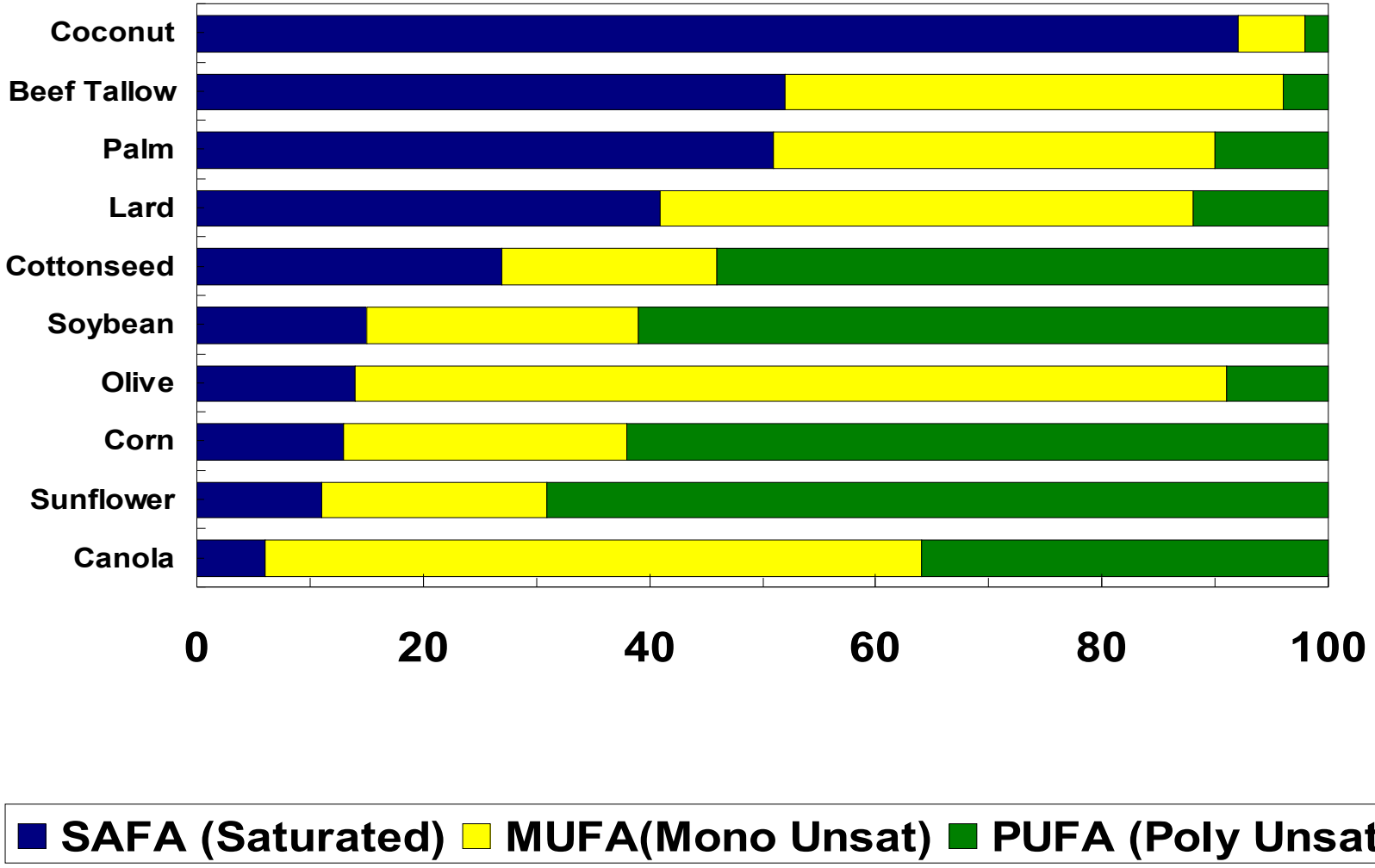
Fats and Oils

Functionality and Selection in Foods

Edible Oil Sources



Typical Compositions of Edible Fats & Oils



Fatty Acids Dictate the Triglycerides Characteristics

- Saturated Fatty Acids
  - Single bonds between all carbon pairs
  - Fats with high amounts of Saturated Fatty Acids are solid at room temperature
    - Coconut
    - Palm
    - Beef Tallow, Lard

- Unsaturated Fatty Acids
  - Double bonds between one or more pairs of carbon atoms
  - Fats with high amounts of Unsaturated Fatty Acids are liquid at room temperature.
    - Soybean
    - Canola
    - Corn
    - Peanut

Dietary Fatty Acids Have Chain Lengths Between 4 & 24 Carbons

Name	Abbreviation	# Carbons	# double bonds	Double bond position	Melting Point °C
Butyric	C4:0	4	none		-7.9
Caproic	C6:0	6	none		-3.4
Caprylic	C8:0	8	none		16.7
Capric	C10:0	10	none		31.6
Lauric	C12:0	12	none		44.2
Myristic	C14:0	14	None		53.9
Palmitic	C16:0	16	None		63.1
Palmitoleic	C16:1	16	1	Ω-9	0.5
Stearic	C18:0	18	None		69.6
Oleic	C18:1	18	1	Ω-9	13.4
Linoleic	C18:2	18	2	Ω-6 / Ω-9	-8
Linolenic	C18:3	18	3	Ω-3 / Ω-6 / Ω-9	-14.5
Arachidic	C20:0	20	none		75.3
EPA	C22:5	22	5	Ω-3 ….	Really low
DHA	C24:6	24	6	Ω-3 ….	Really low

Fats & Oils and Functionality

- Characteristics of Domestic Oils
  - Liquid
  - Low in Saturated Fatty Acids
  - Trans Fatty Acid Free
  - Susceptible to Oxidation
  - Application functionality limited

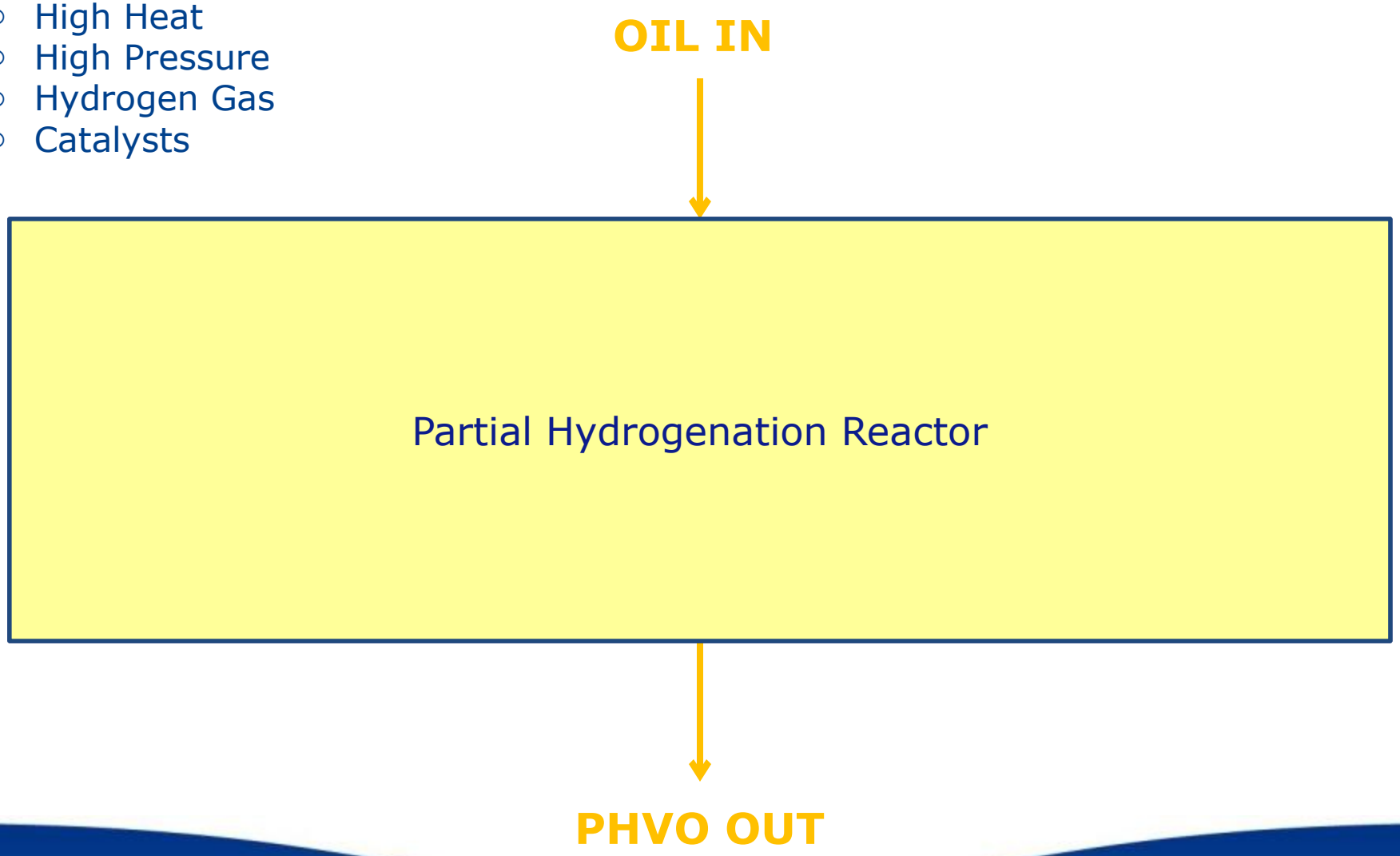
Hydrogenation
Modification of Domestic Oils

Objective

- Stability
  - Increase resistance to oxidation
- Functionality
  - Impart functional characteristics
    - Structure
    - Performance

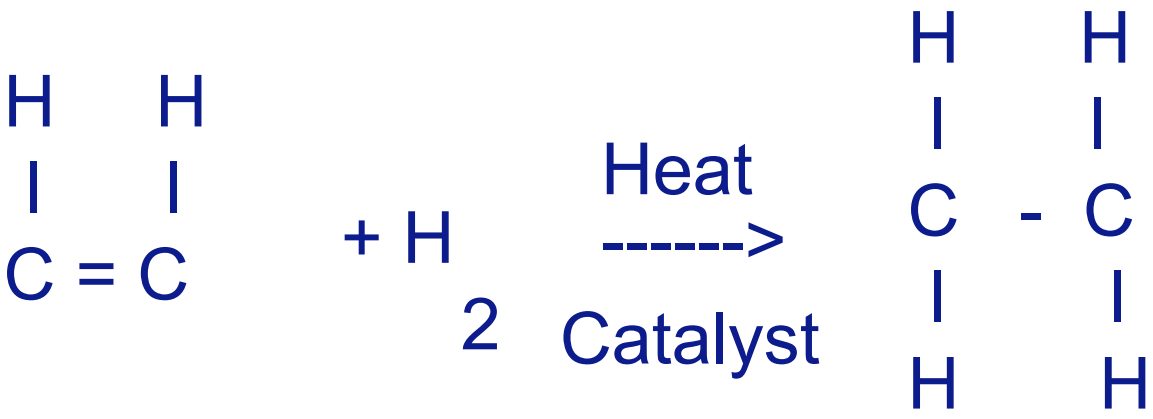
Partial Hydrogenation Process

- High Heat
- High Pressure
- Hydrogen Gas
- Catalysts



Hydrogenation

- Addition of hydrogen to the molecule of an unsaturated organic compound
- The double bonds in unsaturated fatty acids are highly reactive
- In the presence of a suitable catalyst; e.g.. Nickel
- Hydrogen can be added to the double bond

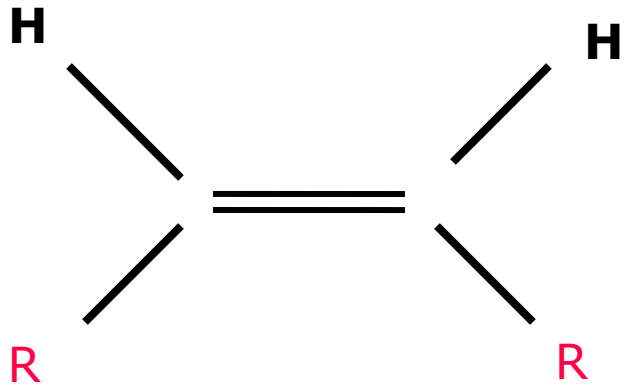


Hydrogenation

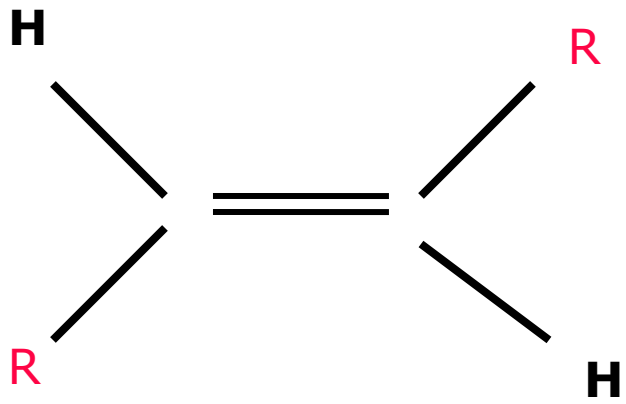
- Hydrogenation results in:
  - Higher Melting Point
  - Higher Solid Fat Content
  - Longer shelf life (Oxidative Stability)
- Unwanted consequence of Hydrogenation
  - Produces amounts of Trans Fatty Acids

Geometric Isomers of Fatty Acids

Structure of trans double bonds

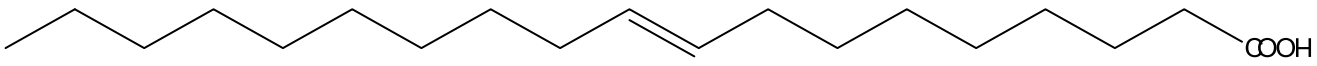


CIS
Double Bond

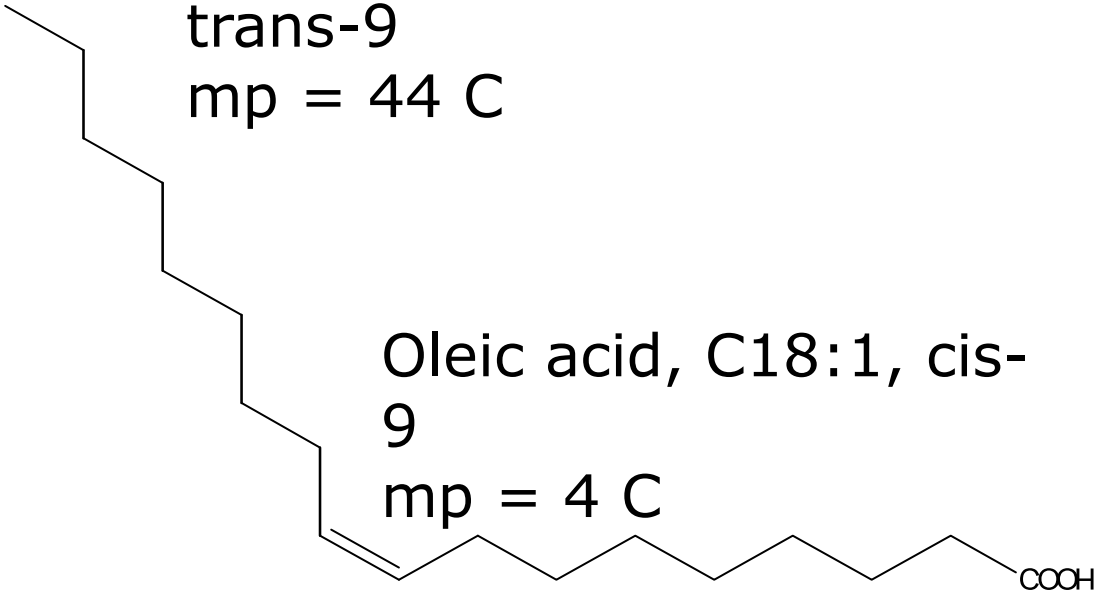


TRANS
Double Bond

Cis and Trans Fatty Acids



Elaidic acid, C18:1, trans-9
mp = 44 C



Oleic acid, C18:1, cis-9
mp = 4 C

- Cis fatty acids predominate in both meat & vegetable oils
- Small amounts of trans fatty acids are present in the fat of ruminant animals
- Large amounts of trans fatty acids are created in the hydrogenation process

Effects of Hydrogenation

	Soybean Oil			
Melt Point C./F.		31 / 87.8	36.5 / 97.7	40.5 / 104.9
SFC @ 10 C.		17	53	67
@ 20 C.		8	33	50
@ 30 C.			10	21
SAFA	15	17	19	23
SAFA + Trans	15	52	66	75
AOM, hrs	12	50	150	200
OSI @ 130 C.	1.5	4	10	12

Examples of Hydrogenated Products

- Shortenings
- Margarine oil base stocks
- Frying oils
- Structuring Fats
- Confectionery Fats
- Imitation Dairy Fats

Trans Fat Replacement Options

PHO Replacement

Challenges

- Plasticity – Required texture and melting properties for multiple functions
- Stability – Shelf life and oxidative stability
- Economics – Reliable source and price

Options

- Palm based shortenings
- Blended shortenings
- Interesterified (IE) shortenings
- Liquid oils
- Animal Fats
- Butter

Blended Shortenings

Pros

- No Trans Fats
- Numerous oil source choices available
- Emulsifier additions provide functionality in applications

Cons

- Fully Hydrogenated – Hydro on label
- Liquid Oil – Oxidative stability
- Cost and availability
- Texture limitations
- Limited functionality in applications

Interesterified (IE) Shortenings

Pros

- Texture comparable to all-purpose shortenings
- Domestic oil utilization
- No trans fat

Cons

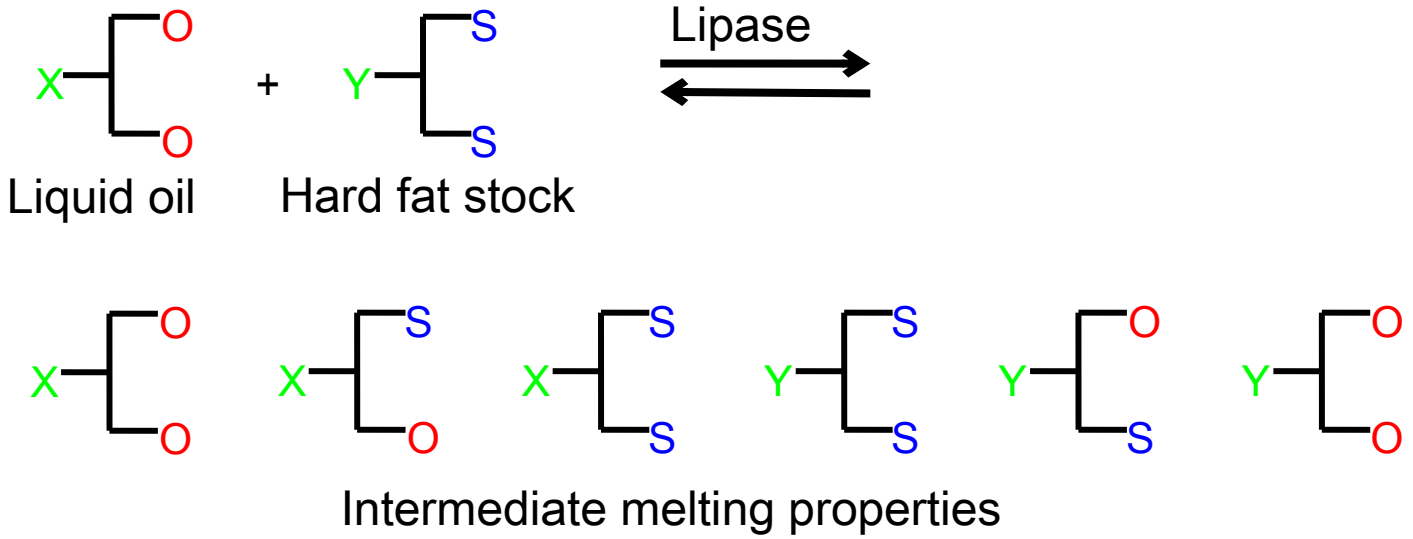
- Components are liquid oil and fully hydrogenated , labeled as “interesterified soybean”
- Limited texture
- Oxidative stability- PUFA levels

Interesterification

Chemical (catalyst: sodium methoxide or sodium ethoxide)

- Random interesterification

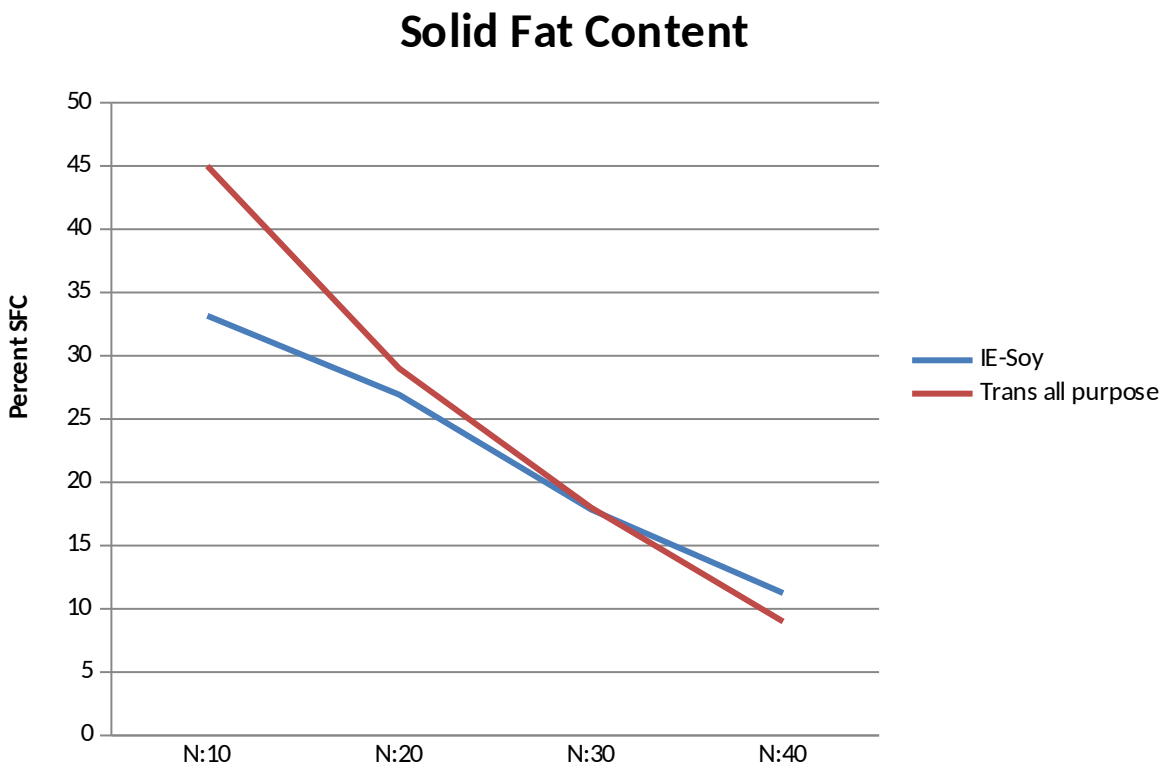
- **Enzymatic** (catalyst: lipase)
  - 1,3 specific interesterification



Interesterified (IE) Shortenings

	IE-Soy	Trans all purpose
N:10	33	45
N:20	27	29
N:30	18	18
N:40	11	9

	IE-Soy	Trans all purpose
SAFA	40	26
MUFA	16.4	32
PUFA	42.3	6
Trans	<2	35



Plant BreedingTechnology

- Soybean Oil:
  - High Oleic
  - Low Linolenic
- Canola Oil:
  - High Oleic
- Sunflower
  - Mid Oleic Sunflower
  - High Oleic Sunflower

Plant Breeding Technology

	Mono unsaturates	Poly unsaturates	Saturates
Soybean			
Commodity	23%	57%	15%
High Oleic	80%	6%	12%
Low Linolenic	25%	59%	15%
Canola			
Commodity	60%	30%	7%
High Oleic	75%	17%	7%
Low Linolenic	65%	26%	7%
Sunflower			
Commodity	20%	66%	10%
Mid oleic	56%	33%	9%
High Oleic	82%	10%	8%

Liquid Oils

Pros

- Ease of handling
- Economics and availability
- Low SAFA
- No Trans

Cons

- Stability and shelf life
- Limited functionality
- Cost and availability of oils via “breeding technology”

Animal fats

Pros

- Economical
- Prior use in food products

Cons

- No Kosher/ Halal
- Contains cholesterol
- Limited functionality
- Stability and flavor concerns

Butter

Pros

- Availability
- Prior use in applications
- Flavor

Cons

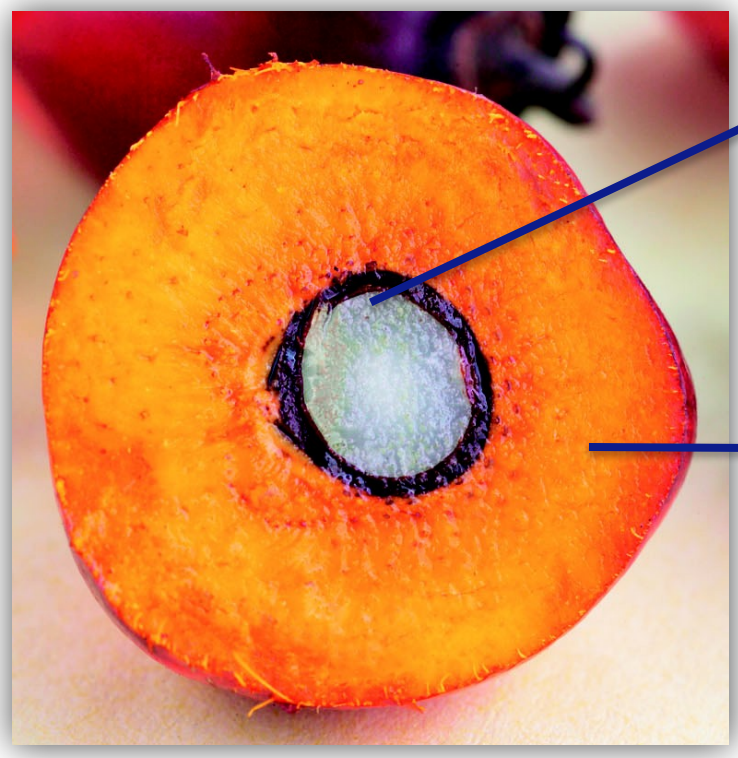
- Dairy Allergens
- Cost implications
- Limited functionality
- Handling concerns
  - Refrigeration
  - Tempering before use

Palm Oil

Palm Fruit Bunch

- Palm Fruit Bunch is composed of > 1000 fruitlets which are approximately 1 inch in diameter
- Tree produces 12 bunches per year
- Each bunch weighs 20-30 kg

The Fruit of the Oil Palm



Kernel → Palm Kernel Oil

The Kernel:

- 5-8% of Fruitlet
- 50% oil content
- Yields oil with primarily c12 & c14 fatty acids.
- The oil can either be expeller pressed, bleached and physically refined.

Mesocarp → Palm Oil

Mesocarp:

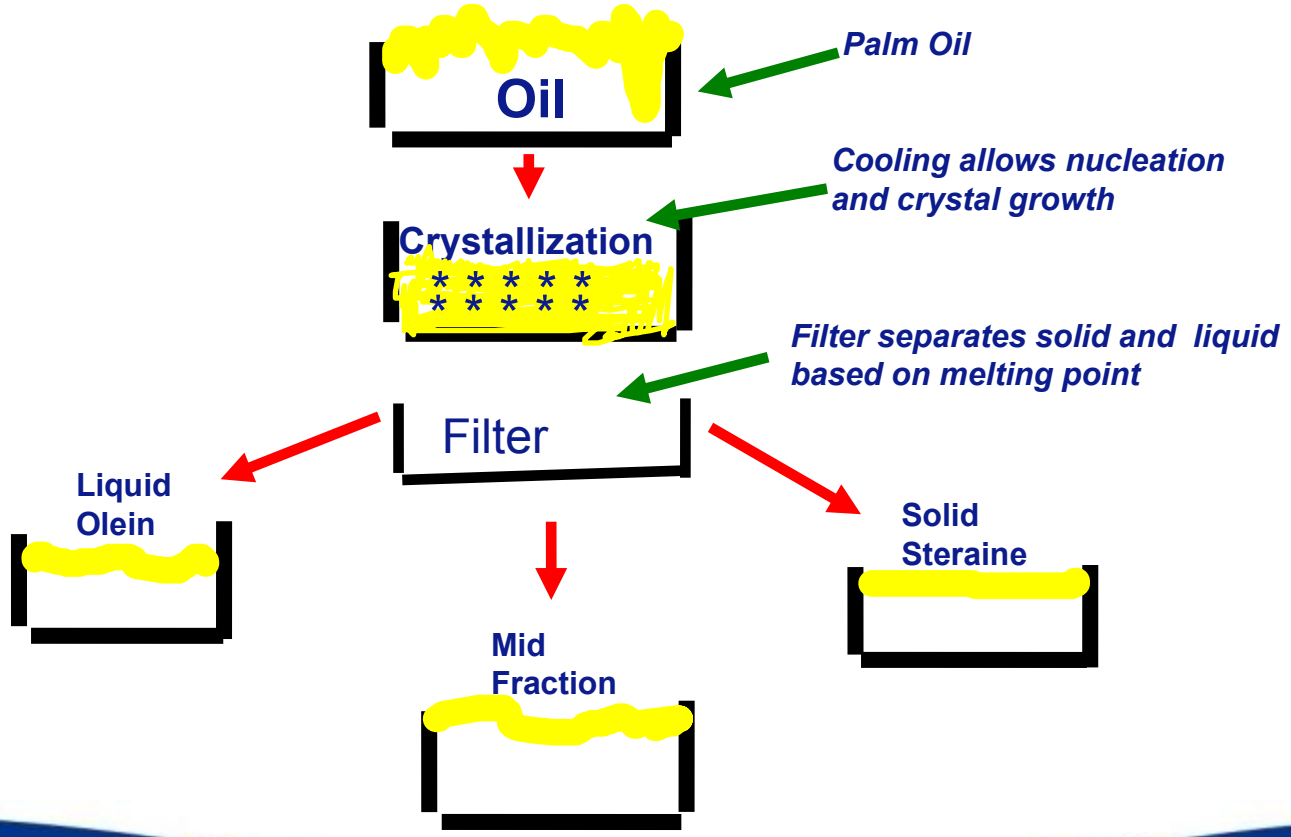
- 85-92% of the Fruitlet
- 49% oil content
- Yields oil with primarily c16 & c18 fatty acids.
- The oil is expeller pressed, bleached and physically refined.

Composition of Palm Oils

Fatty Acid	Palm Oil	Palm Kernel
c12:0 Lauric	0.2	46.7
c14:0 Myristic	1.0	16.1
c16:0 Palmitic	44.0	8.7
c18:0 Stearic	4.4	2.2
c18:1 Oleic	39.4	16.7
c18:2 Linoleic	9.7	2.5

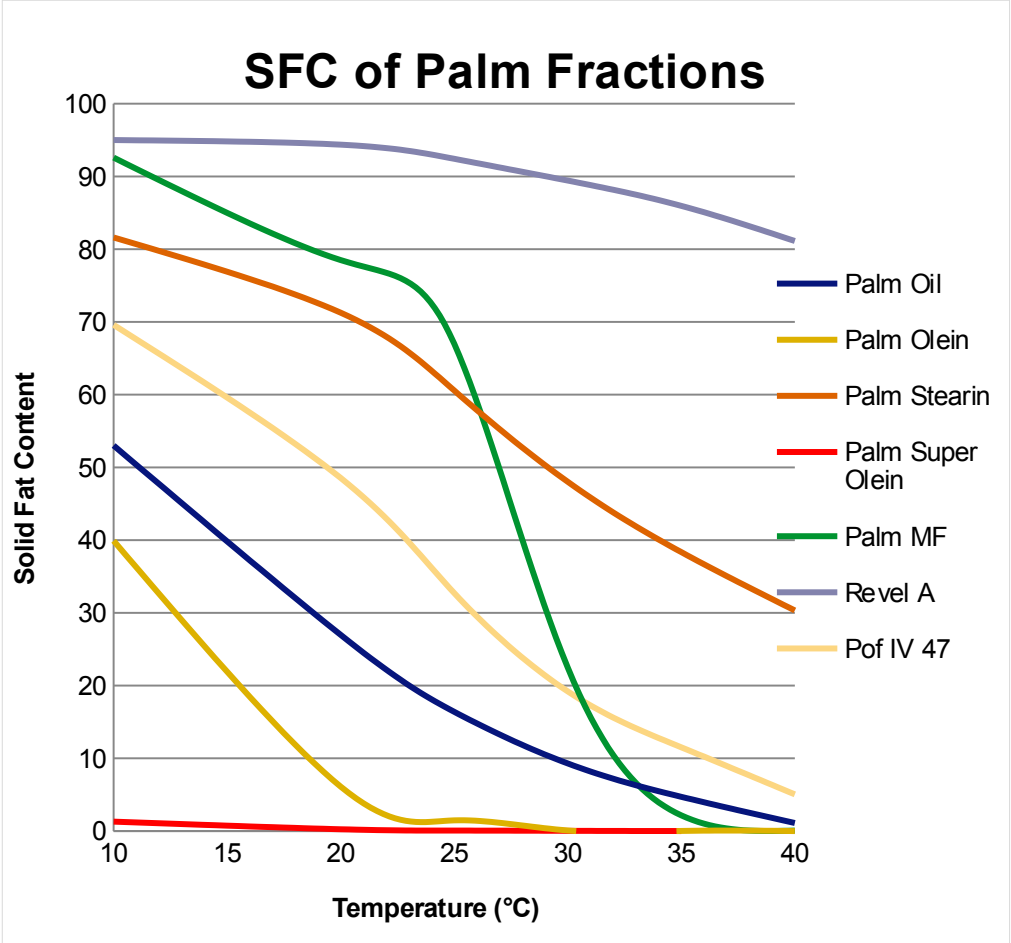
Palm Oil Versatility: Fractionation

- Separation of a mixture into different components
- Solid and Liquid triglycerides are separated by fractional crystallization on the basis of differences in their melting point.

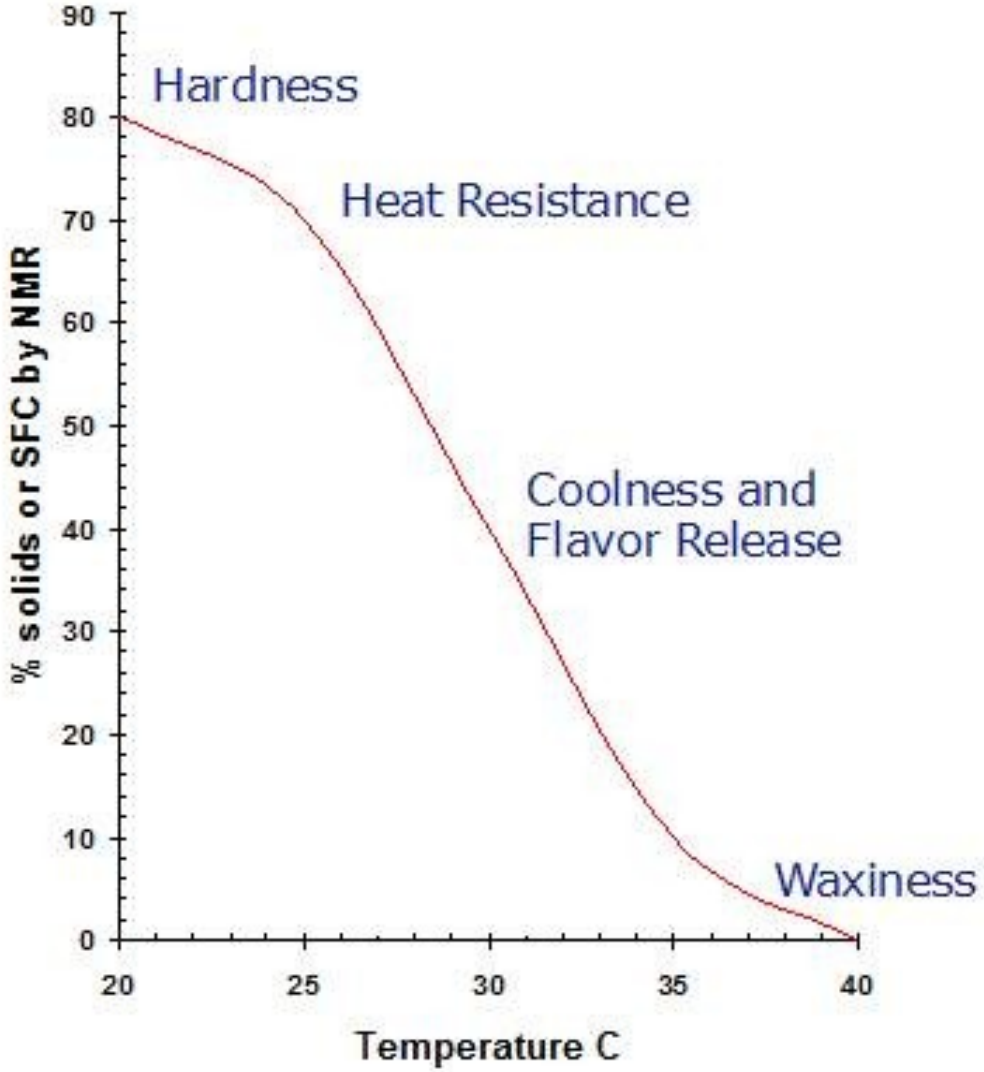


Solid Fat Content of Fractions

- Palm Oil is slushy at room temperature
- Palm Stearin is very hard with a high melting point
- Palm Olein is liquid at room temperature with some suspended solids
- Palm Mid-Fraction is steep melting, hard at room temperature, melts at body temperature
- Palm Olein 62IV is completely liquid at room temperature



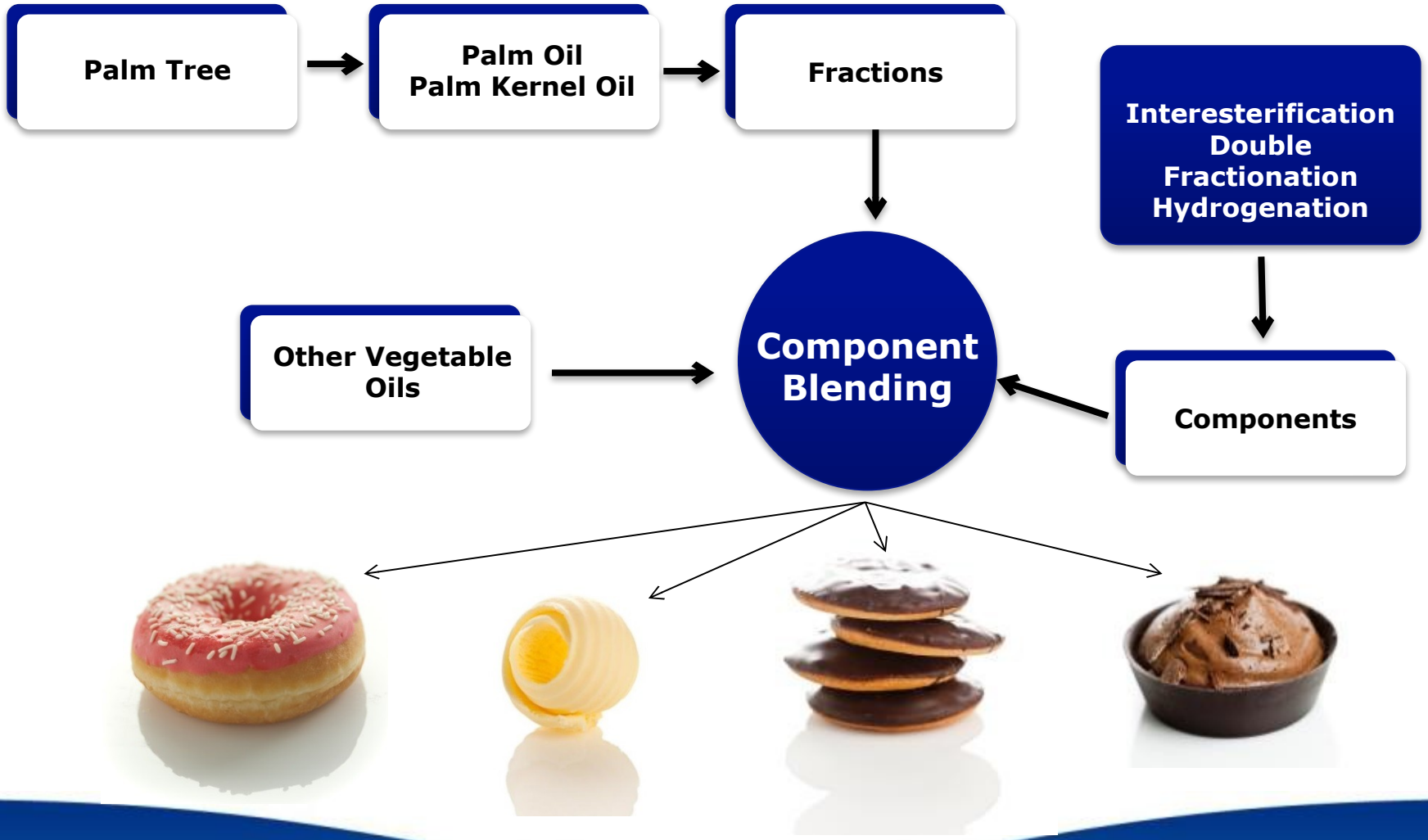
SFC Interpretation



Palm Oil as a Solution

- Naturally Solid Fat
  - Crystal structure in palm oil ideal for creaming and smooth texture
    - No chemical processes (hydrogenation) required
- Long Shelf Life
  - Contains balanced content of saturated and monounsaturated fats
  - No Linolenic acid
- Versatile: Almost Unlimited Variety of Textures
  - Including liquid oils

Versatile Approach to Innovative Product Development



Elimination of PHOs

The Role of Palm Oil

Composition of Products

Composition of Products: Bakery Fats			
	Trans	Sats	Unsats
Partially Hydrogenated	35%	22%	43%
Palm Oil	0.5%	51%	48%
Palm Oil + Canola	0.5%	34%	65%

Composition of Palm Oil Products: Industrial Deep Fat Frying Fat			
	Trans	Sats	Unsats
Partially Hydrogenated	27%	15%	58%
Palm Oil (liquid)	0.5%	41%	58%
Palm Oil + Soybean Oil	0.5%	32%	67%

Composition of Palm Oil Products: Confectionery Fats			
	Trans	Sats	Unsats
Partially Hydrogenated	50%	25%	25%
Palm Kernel	0.5%	96%	3%
Palm Oil	0.5%	64%	35%

What is a “Bakery Shortening”

- “Shortening” is a bakers term
- Fat in the finished product “shortens” or tenderizes the texture of the finished product
- Function of shortening in bakery product:
  - Dispersing agent for various ingredients
  - Lubricity
  - Structure
  - Aeration
  - Eating quality
  - Shelf life
  - Nutritional
    - Originally necessary
    - Present “how it effects our health”

Bakery Items and Shortening Use

All bakery items use shortenings in one form or another
- Packaged
- Bulk – requires further processing by the end user

Many bakery products require multiple shortenings for use in the same product in different parts

e.g. Snack Cake
- Shortening for:
  - Cake
  - Icing
  - Filling

Therefore one or more shortenings with functional characteristics are needed to satisfy multiple applications within a baked product.

Shortening for Baked Goods

Attributes
- Solid, smooth texture
- Ability to aerate with other ingredients
- Long shelf life (flavor)
- Versatility – many different textures and eating qualities required

Solutions
- A solid fat is essential for most applications
  - Only saturated and trans fats provide solid texture

Bakery Shortenings

- Triglyceride components of the fat system control the functionality and consistency.

- The ability to produce the desired effect in bakery products is dependent upon –
  - Molecular composition
    - Solid Fat Content – ratio of solid triglycerides to liquid components.
    - Crystal habits – size, shape and polymorphic form of the solid triglycerides.

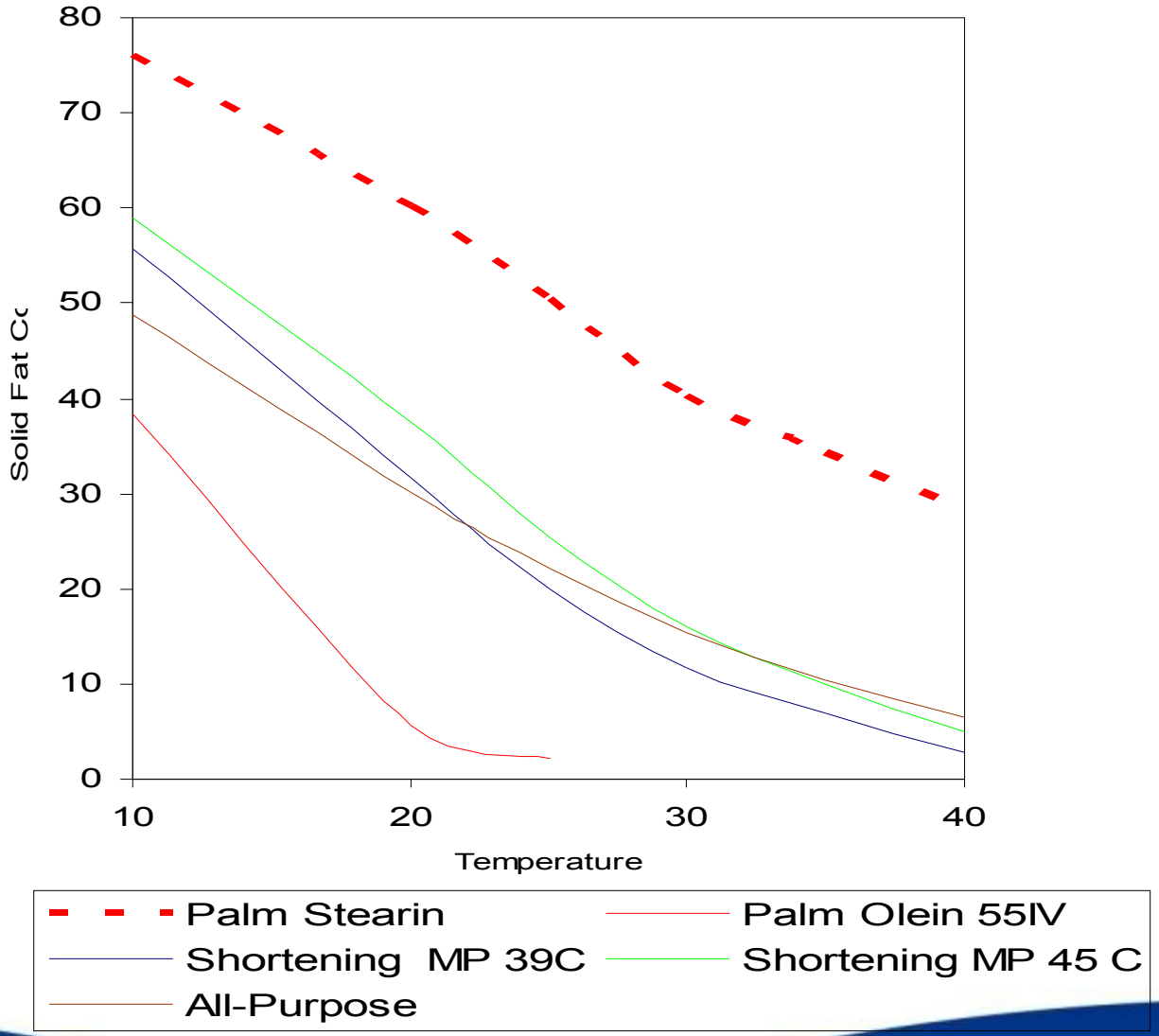
Performance Measurement

Bakery Shortening Performance Criteria

- Beta Prime and crystal structure well knit together
- Proper ratio - optimum level of crystalline triglycerides to entrain the oil phase properly
- Oxidative stability

Making Shortenings with Palm

Palm fractions may be blended to formulate shortenings that approximate the solids of Traditional shortenings.



SansTrans™ No Trans, Non Hydrogenated Shortenings

Hard Plastic

Soft Plastic

SansTrans™ 45	**Plastic**	**50lb. votated poly-lined cartons and in liquid form**	**Mettler Dropping Point: 48°C/118°F**	
			Color (5 ¼")	**5R Max**
			SFC at 10°C	**61**
			SFC at 20°C	**41**
			SFC at 30°F	**19**
			SFC at 40°F	**7**
SansTrans™ 42	**Plastic**	**50lb. votated poly-lined cartons and in liquid form**	**Mettler Dropping Point: 42°C/108°F**	
			Color (5 ¼")	**5R Max**
			SFC at 10°C	**56**
			SFC at 20°C	**34**
			SFC at 30°F	**14**
			SFC at 40°F	**5**
SansTrans™ 39	**Plastic**	**50lb. votated poly-lined cartons and in liquid form**	**Mettler Dropping Point: 40°C/105°F**	
			Color (5 ¼")	**5R Max**
			SFC at 10°C	**55**
			SFC at 20°C	**31**
			SFC at 30°F	**11**
			SFC at 40°F	**2**
SansTrans 35	**Plastic**	**50lb. votated poly-lined cartons and in liquid form**	**Mettler Dropping Point: 37°C/95°F**	
			Color (5 ¼")	**5R Max**
			SFC at 10°C	**48**
			SFC at 20°C	**23**
			SFC at 30°F	**7**
			SFC at 40°F	**0**

Specialty Shortenings

Cakes
Shortening Requirements

- Standard Cake Shortening (non-emulsified)
- Traditional Aeration – Fat phase aeration – air is entrapped in the shortening matrix.
- Requirements
  - "Plastic Shortening"
  - Proper ratio of liquid fat (entraps air) to solid fat (stabilize air)
  - Beta prime crystal structure

Standard Cake Shortening Functionality

- Shortening and Sugar are blended and aerated commonly known as "creaming step"
- Sugar/shortening, egg protein, and flour are dispersed in the aqueous phase.
- Upon baking, fat melts, air passes into the aqueous phase.
- Air release helps to obtain volume in baked cake

Specialty Cake Shortenings Emulsified

Formulated in the same manner as standard cake shortenings but with added emulsifiers

Emulsifier Functionality – Role of Emulsifiers

- Aid in the distribution of shortening in the mix
  - Regular finer cake structure
  - Higher sugar-flour ratio
  - Volume improvement
  - Improved eating qualities
    - Greater crumb softness and friability in the mouth
  - Starch complexing - anti staling
    - Delay starch retrogredation
    - Extended shelf life

Advantages

- Emulsification
  - Standard cake shortenings are unable to form an emulsion when large amounts of sugar and liquids are used
  - Emulsifiers promote phase equilibrium between the oil and water phase.
  - Surface tension is reduced and stability is provided to the system.

Cakes

Emulsifier Functionality

- Emulsification
- Starch Interaction
  (Anti-Staling)
- Aeration

Shortening

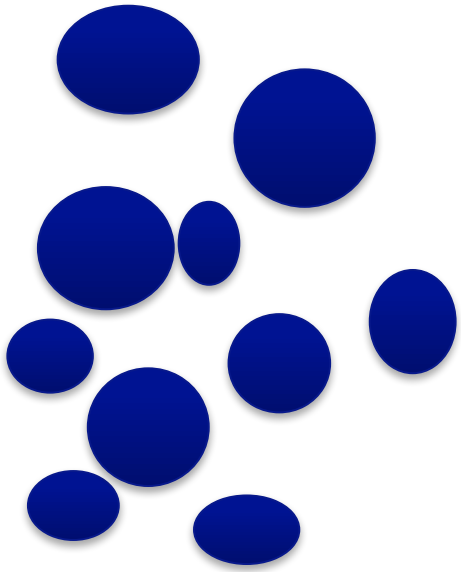
- Provide texture and character
- Improve the cakes eating quality
  - Shortenings melt point effects the cakes texture.
  - Shortening with a high melt point will solidify after that cake has cooled and effect eating quality.
  - Liquid shorting addition imparts a “moistness” to the eating quality

Emulsifiers

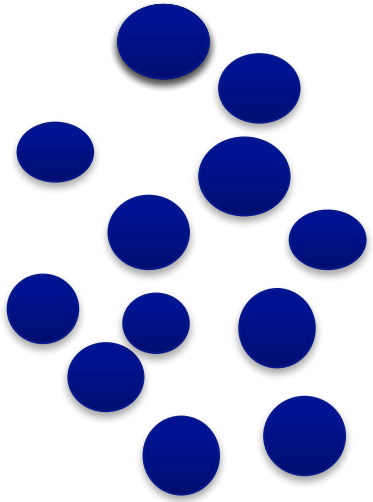
- Contribute to emulsion stability
- Enhance and expand upon the properties of the shortening.
- Use of emulsifiers allows for the creation of a better cake
  - More sweeter
  - More Tender
  - Moister

Emulsification

Fine and Uniform Dispersion



Unemulsified



Emulsified

Aeration

Role of Propylene Glycol Monoesters (PGME)

- Aid Monoglycerides
  - Batter formation and stabilization

- Alpha-Tending Emulsifiers
  - Form an alpha-crystalline film around the air bubbles entrapped in the cake batter – overcome the detrimental action of fatty materials on foaming properties of protein solutions
  - Allow air entrapment in “aqueous foam” instead of just the “lipid” matrix

- PGME and Lactylated Monoglycerides

Cake Types

High Ratio	Low Ratio
Cakes that have more sugar than flour	Cakes with less sugar than flour
Less viscous cake batter	Stiffness of the batter necessary to retain leavening gasses.
Contains higher amounts of water	
Emulsifiers allow use of higher amounts of water to dissolve the sugar.	

Bakery Icings

Icing

- A liquid sugar-water system augmented with appropriate ingredients for use as a decorative and flavor-enhancing cover or coating on cakes, sweet dough products, donuts, cookies.
- Icings may either be non-aerated i.e. “flat icing” or aerated to various degrees.

Flat Icing

- Little or no air incorporation

Cream Icings

- “Fluffy” icings varying degree of air incorporation

Fudge and Fondant Icing

- “Denser Texture”
- Reduced sugar crystal size during cooking effects gloss, appearance and texture

Shortenings for Bakery Icings

Shortening Functionality

- Designed to incorporate large quantities of air
- Reach low specific gravities in short period of time
- Ability to retain incorporated air and liquids without leakage

Emulsifier Functionality

- Mono and Diglycerides
  - Function - Emulsification
  - Prevent water separation
- Polysorbate 60
  - Aids in aeration (incorporation of air)

Shortenings for Bakery Icings

Why Palm Oil is a good bakery shortening candidate

- Naturally occurring functional saturated triglycerides
- Composition – Beta Prime (palmitic acid).
- Oxidative stability – Low PUFA

Clean Label

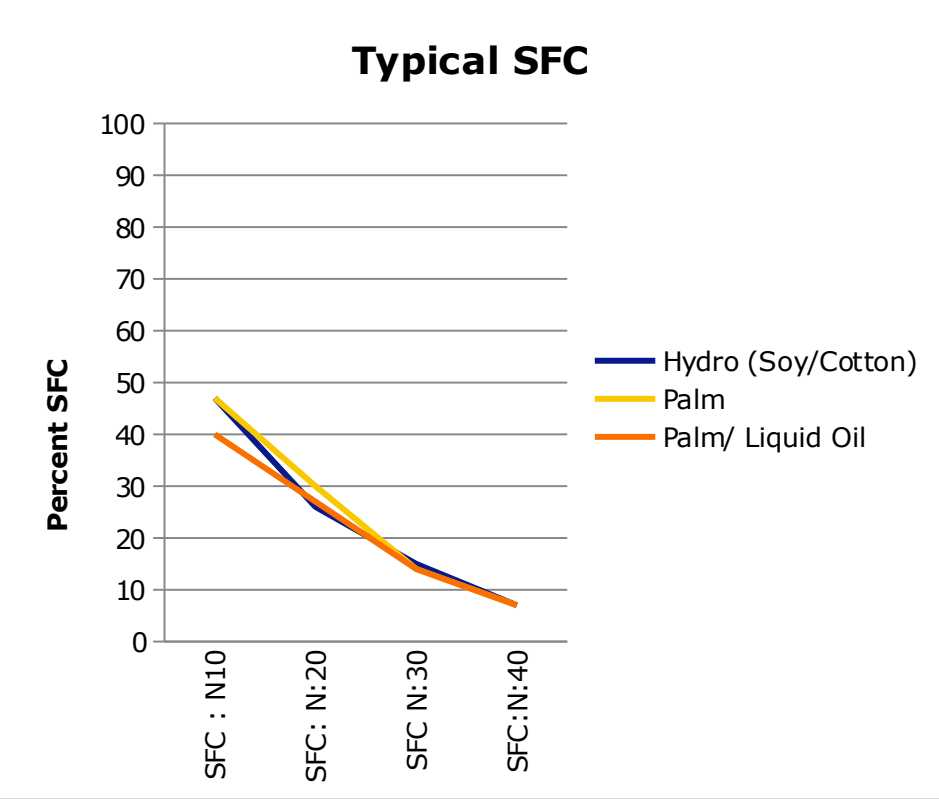
- No "Hydrogenated", no "Interesterified"

Traditional Shortenings - Trans

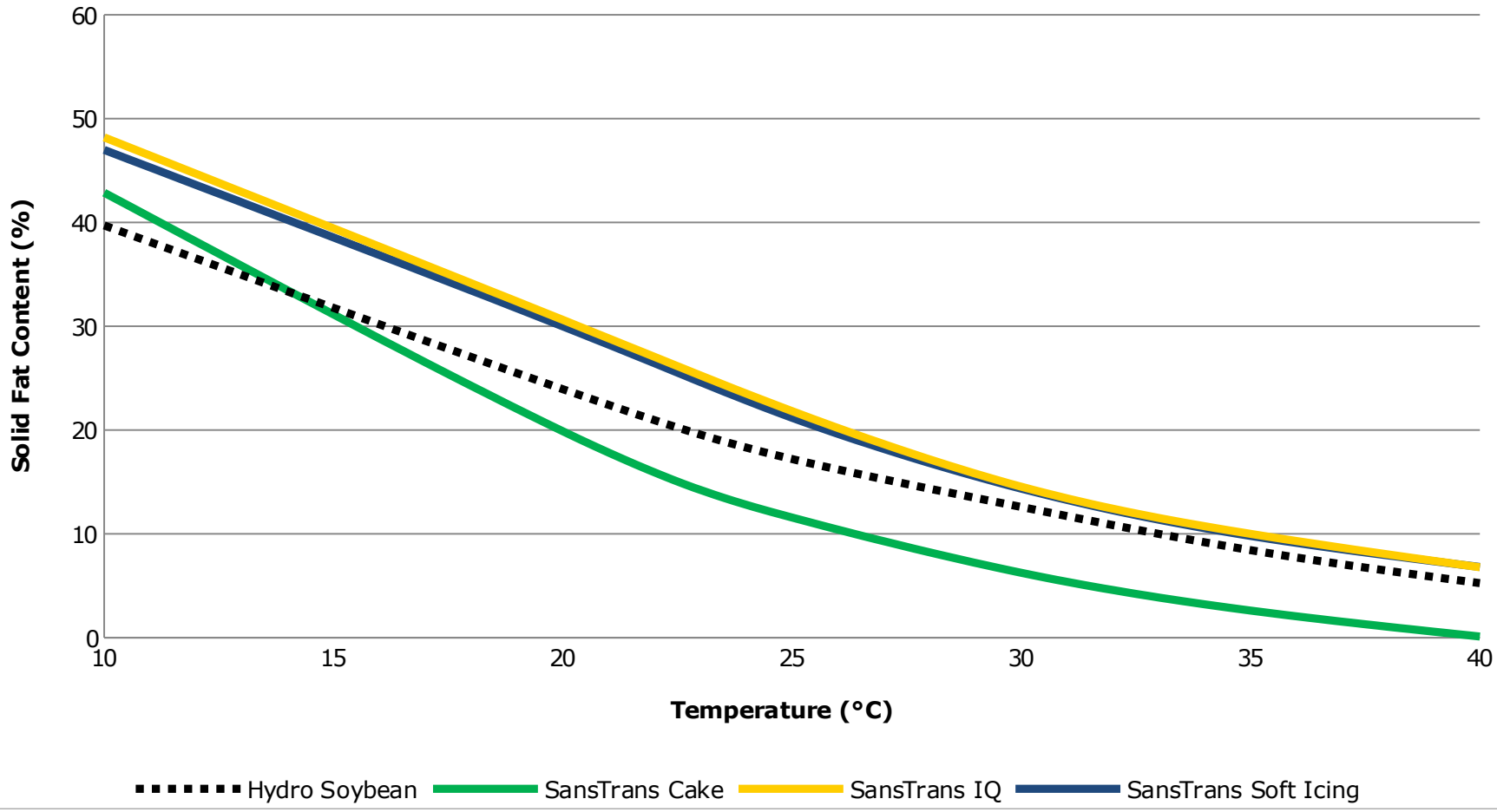
- All-purpose shortenings are a blend of:
  - Partially hydrogenated oil (liquid)
  - Fully hydrogenated Beta prime fat

Shortening Profiles for Icings

Composition	Hydro (Soy/Cotton)	Palm	Palm/ Liquid Oil
SFC : N10	47	47	40
SFC: N:20	26	30	27
SFC N:30	15	14	14
SFC:N:40	7	7	7
SAFA	27	50	38
MUFA	31	39	45
PUFA	9	9	16
Trans	33	1	1



Icing Shortenings



Icing Shortenings for Long Shelf Life

- Icing shortenings consisting of Palm and Canola Oils
- Non Hydro and no trans Fatty Acids
- Maximum Oil Binding properties and organoleptic properties.
- Formulated with blend of Palm and Canola that will not post crystallize(harden) once incorporated into an icing.
- Formulated with Functional emulsifiers
  - Mono and diglycerides
  - Polysorbate 60

Cookie Shortenings

Cookie Shortenings

Shortening Requirements in Cookies

- In cookies, the gluten protein is intentionally not developed
- Fat levels are traditionally higher than in other baked goods

Wire Cut	28-60%
Deposited	32-60%
Extruded	40-75%

(expressed as Bakers Percentage : Ratio Flour/Sugar)

- Fat is a major component and functionality is critical

Cookie Shortening Functionality

Shortening Functionality

- Shortening reduces gluten formation
- Reduces the water uptake of the dough and prevents stickiness.
- “Shortens” baked texture and provides brittleness
- Flavor

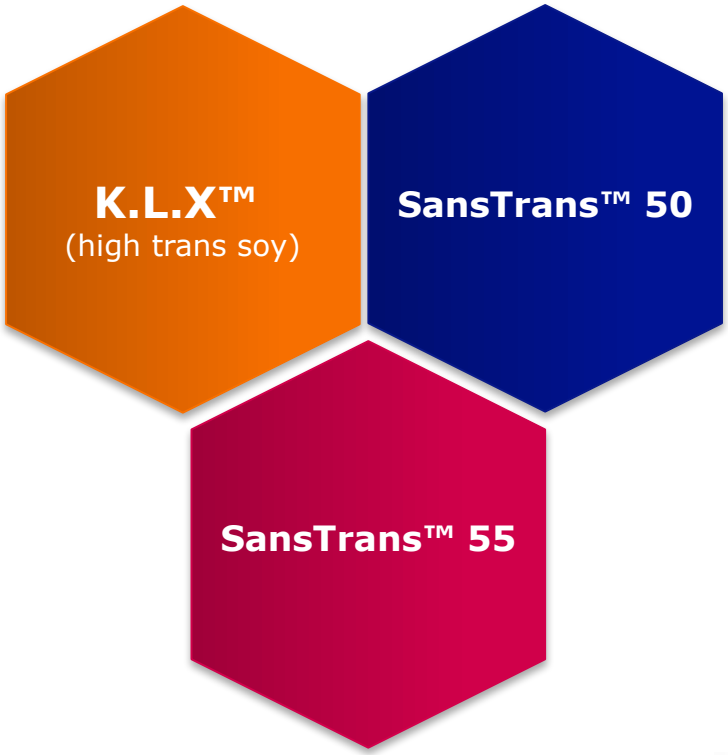
Cookie Shortening Requirements

- Soft “Plastic” over the working range
- Beta prime crystals in shortening associated with large quantities of air.
- Ability to coat ingredients – inhibit water absorption by flour.

Structuring Fats
SansTrans™ No Trans, Non-Hydrogenated Shortenings and Oils

Product	Form	Package	Label Ingredient Statement	Typical Data	Applications
SansTrans™ 55	Flake	50lb. poly-lined cartons and in liquid form	Palm oil, Kosher.	Mettler Dropping Point: 54°C/129°F Color (5 ¼") 5 R Max SFC at 10°C 87 20°C 70 30°C 60 40°C 31	Can be used in breading mixes to assist in bind the breading to the food and in candy for caramel and hard candy to reduce stickiness.
SansTrans™ 50	Flake	50lb. poly-lined cartons and in liquid form	Palm oil, Kosher.	Mettler Dropping Point: 49°C/120°F Color (5 ¼") 5 R Max SFC at 10°C 87 20°C 72 30°C 49 40°C 26	Used as an icing stabilizer in flat and fudge-type icings. Also used in dry mixes biscuits and the flakes can be added without caking and greasiness.
SansTrans™ 50 Gold	Flake	50lb. poly-lined cartons and in liquid form	Palm oil, Lecithin, natural flavor, colored with beta carotene. Kosher.	Mettler Dropping Point: 49°C/120°F Color (5 ¼") 5 R Max SFC at 10°C 87 20°C 72 30°C 49 40°C 26	Used in dry mixes for biscuits and the flakes can be added without caking and greasiness.

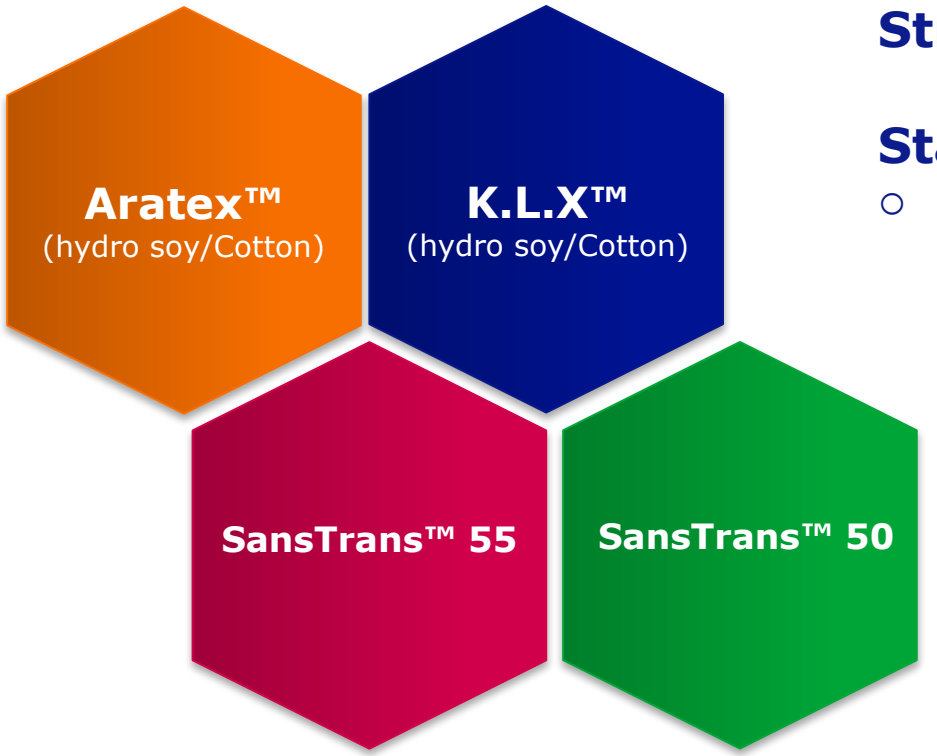
Blitz Pastry Flakes



Structuring Fats Applications

- Added Flake and Texture
  - Biscuits
  - Pie Crust
  - Pizza Crust
  - Pastries
- When used in addition to regular shortening
  - Typically used at ~5%
  - Added during the final mixing stage

Icing Stabilizer



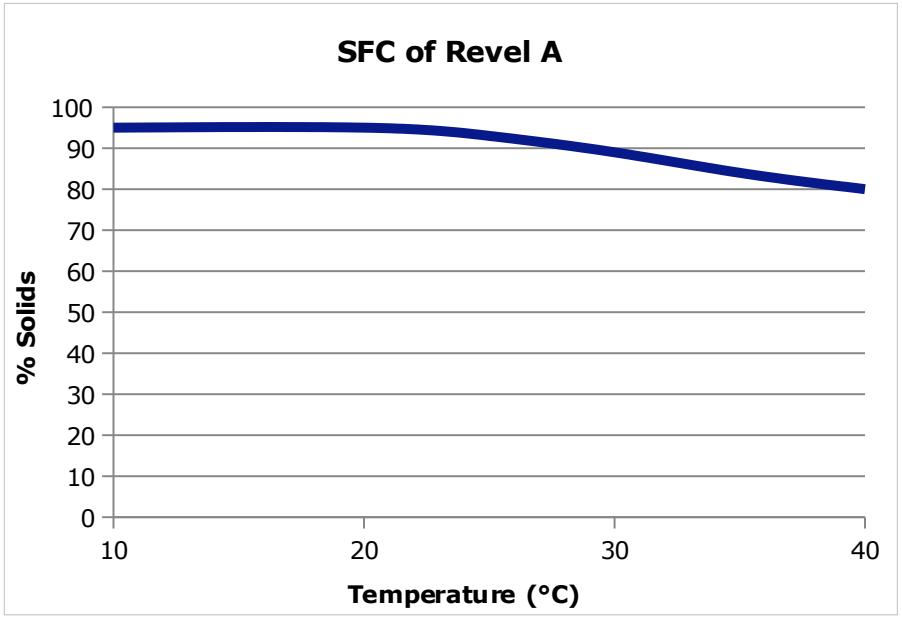
Structuring Fats Applications

Stabilize Flat Icings and Glazes

- Structure Standup
  - Produces icings that will not "bleed" or "collapse"
  - Prevents icings from sticking to wrappers
  - Use at 2 – 5% of the present shortening.

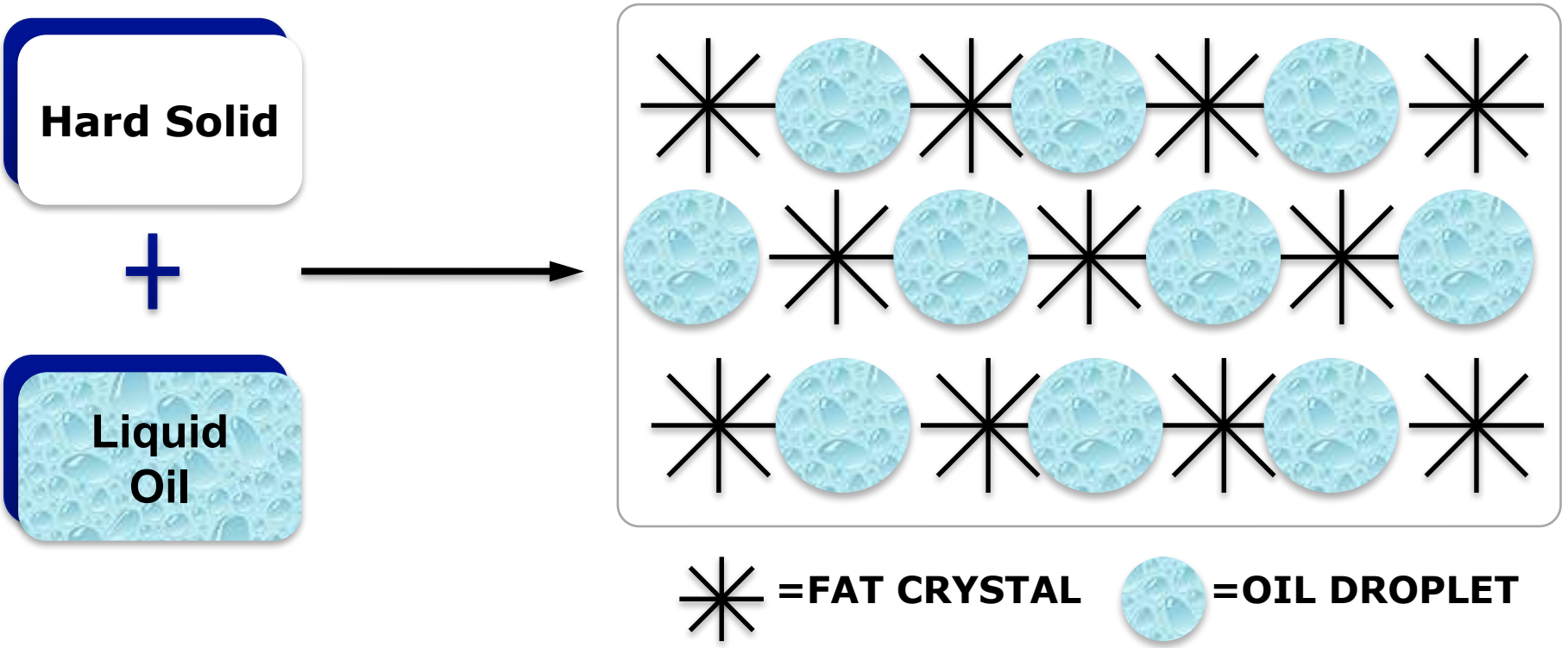
Revel™ A

- Non-Hydrogenated and Trans-Free Structuring Agent
- Non-GMO
- **Peanut Butter Spread Stabilizer** Reduced Oil Separation and Migration
- Rapid Crystallization **and Seeding Agent**
- High Oxidative Stability for Extended Shelf-Life
- **Easily Dispersed** Easy Dispersability in Dry Systems
- Simplified Processing in Terms of Mixing, Dosing, Handling and Storage



Reduction of Saturated Fatty Acids

Use of Fractions to Control Texture



SansTrans™ Reduced Saturate Shortening

	SansTrans™ RS 39 (Reduced)	SansTrans™ 39 (Standard)
SFC @N:10	34	53
SFC @N:20	21	27
SFC @N:30	13	11
SFC @N40	6	4
SAFA	35	50
MUFA	48	40
PUFA	16	9.6
Trans	<1	<1
Label	Palm, Canola, TBHQ	Palm Oil

Fully Functional All Purpose Shortenings

- Blend of Palm and Liquid Canola oils
- Saturated fat reduction can be up to 33% compared to standard palm shortenings
- Non-hydrogenated and no trans fatty acids

Nutrition Facts: SansTrans™ 39 and RS39

SansTrans 39

Nutrition Facts
Serving Size 1 cookie

Amount Per Serving 25g	
Calories 190	Calories from Fat 60
	% Daily Value*
Total Fat 10g	15%
Saturated Fat 5g	25%
Trans Fat 0g	
Cholesterol 15mg	5%
Sodium 100mg	4%
Total Carbohydrate 24g	8%
Dietary Fiber less than 1g	4%
Sugars 15g	
Protein 2g	

Based on 2,000 Calorie Diet

Ingreditent Statement: Enriched Flour (wheat flour, niacin, iron, thiamine monohydrate, riboflavin, folic acid), Palm Oil, Semi sweet chocolate chips (sugar,chocolate liquor,cocoa butter, dextrose, soy-lecithin) Sugar, Brown Sugar, Eggs, Salt, Baking Powder (Bicarbonate of Soda, Sodium aluminum phosphate, monocalcium phosphate) Natural and Artifical Flavors.

SansTrans RS-39 T20

Nutrition Facts
Serving Size 1 cookie

Amount Per Serving 25g	
Calories 190	Calories from Fat 60
	% Daily Value*
Total Fat 10g	15%
Saturated Fat 4g	20%
Trans Fat 0g	
Cholesterol 15mg	5%
Sodium 100mg	4%
Total Carbohydrate 24g	8%
Dietary Fiber less than 1g	4%
Sugars 15g	
Protein 2g	

Based on 2,000 Calorie Diet

Ingreident Statement: Enriched Flour (wheat flour, niacin, iron, thiamine monohydrate, riboflavin, folic acid), Vegetable Shortening (Palm, Canola), Semi sweet chocolate chips (sugar,chocolate liquor,cocoa butter, dextrose, soy-lecithin) Sugar, Brown Sugar, Eggs, Salt, Baking Powder (Bicarbonate of Soda, Sodium aluminum phosphate, monocalcium phosphate) Natural and Artifical Flavors.

Palm Oil

The Sustainable Solution

IOI Loders Croklaan

Let's create together

IOI GROUP

Who We Are

IOI Group's Controlled Integrated Supply Chain

IOI Group

IOI GROUP

- RM 4.1 billion revenue
- Listed on Bursa Malaysia stock market
- 30,000 employees

Plantations

- 250,000 hectares
- 14 mills with > 4 million MT capacity, 12 RSPO certified
- Enhanced agronomy R&D and yield management

Oleochemical

- The largest vegetable oil based Asian oleochemical manufacturer
- Combined refining capacity > 750,000 MT
- Global distribution

IOI Loders Croklaan

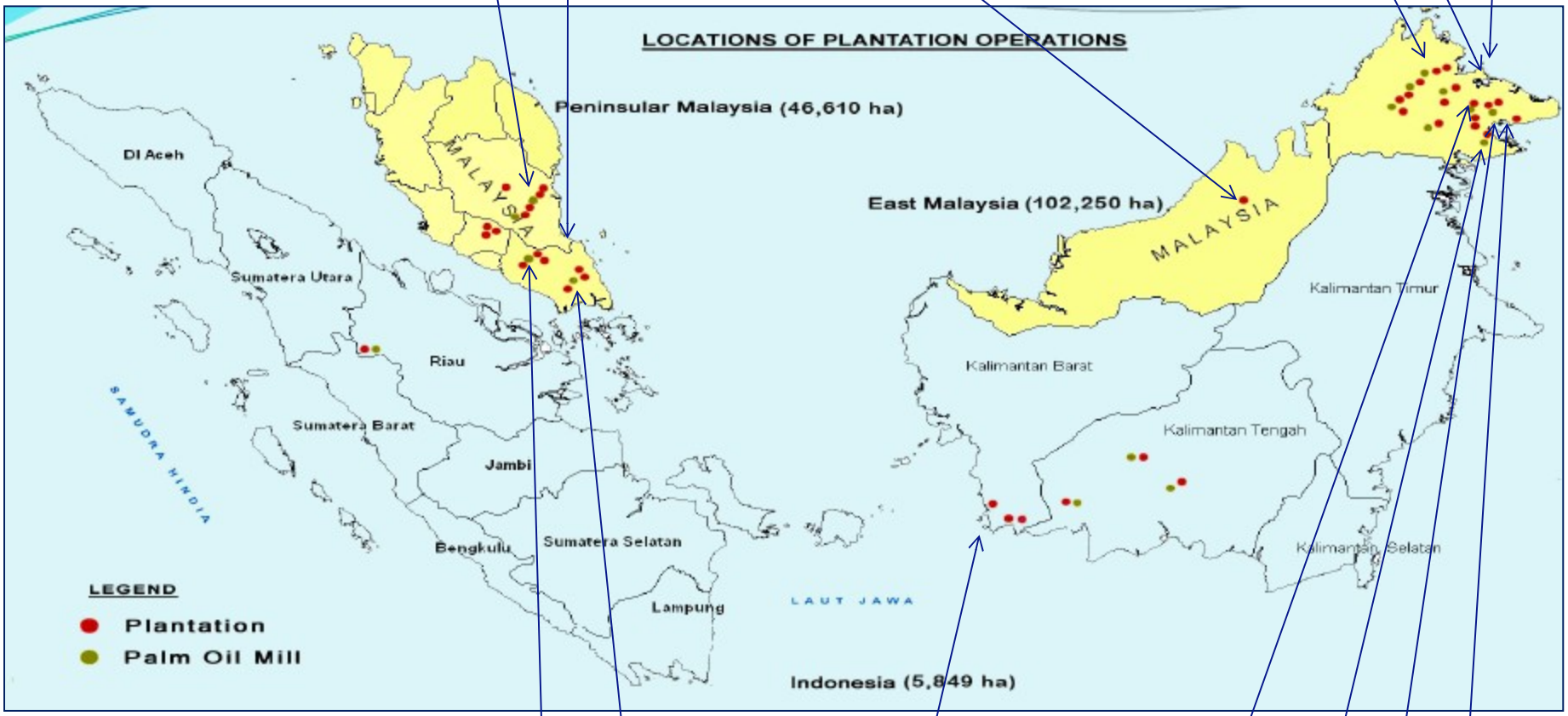
- Specialist & leading player in tropical oils
- Expert in commodities and specialties
- 3 million MT refining capacity

IOI Loders Croklaan's Capabilities

- We are a **downstream processing** division of IOI Group and one of the world's largest **integrated** palm oil producers
- We develop **specialty oils & fats** primarily for the food industry
- Segment offerings include bakery, confectionery and pet food
- Our focus is creating **tailored** offerings for our customers
- We leverage our responsible supply chain with **operating excellence**
- All of this is complimented by our **R&D and application leadership**

6 Refineries for Worldwide Delivery

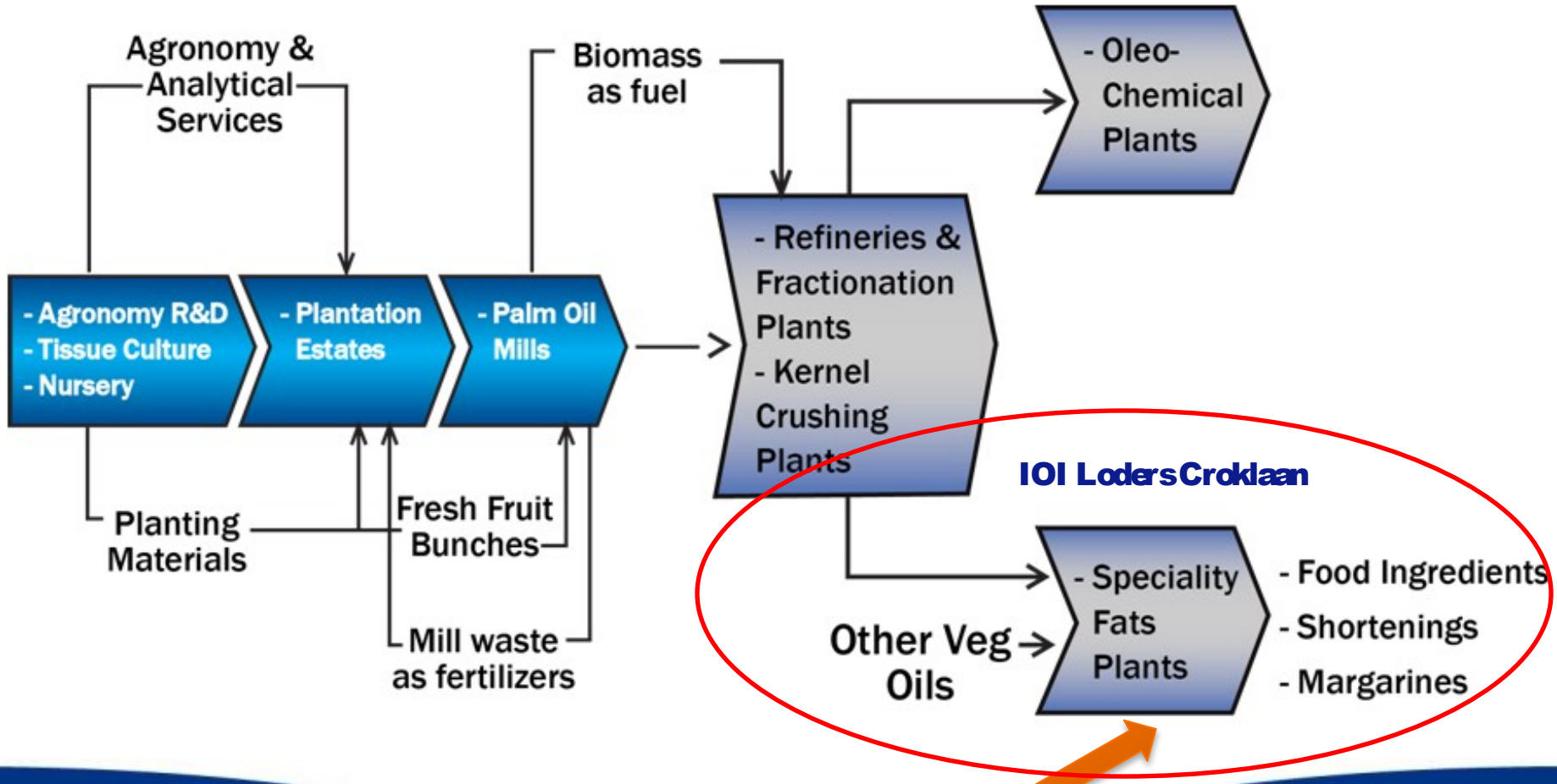
IOI Plantations



Bukit Lee Lau
Pukin
(IOI Pelita)
Pamol Sabah
Ladang Sabah
Mayvin
Leepang
Gomali
Pamol Kluang
(Ketapang)
Sakilan
Baturong
Morisem
Syarimo

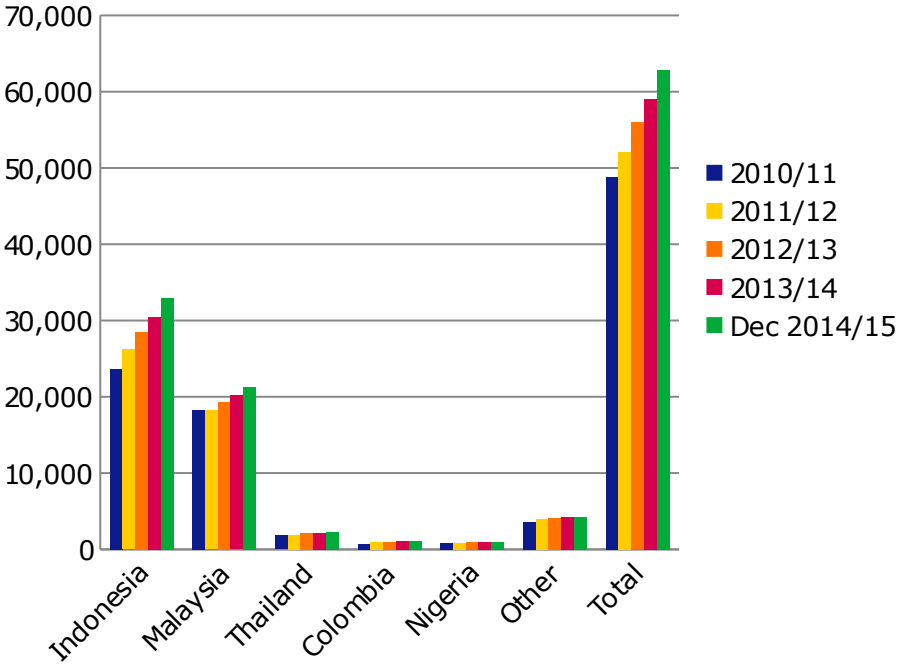
IOI GROUP

Activities

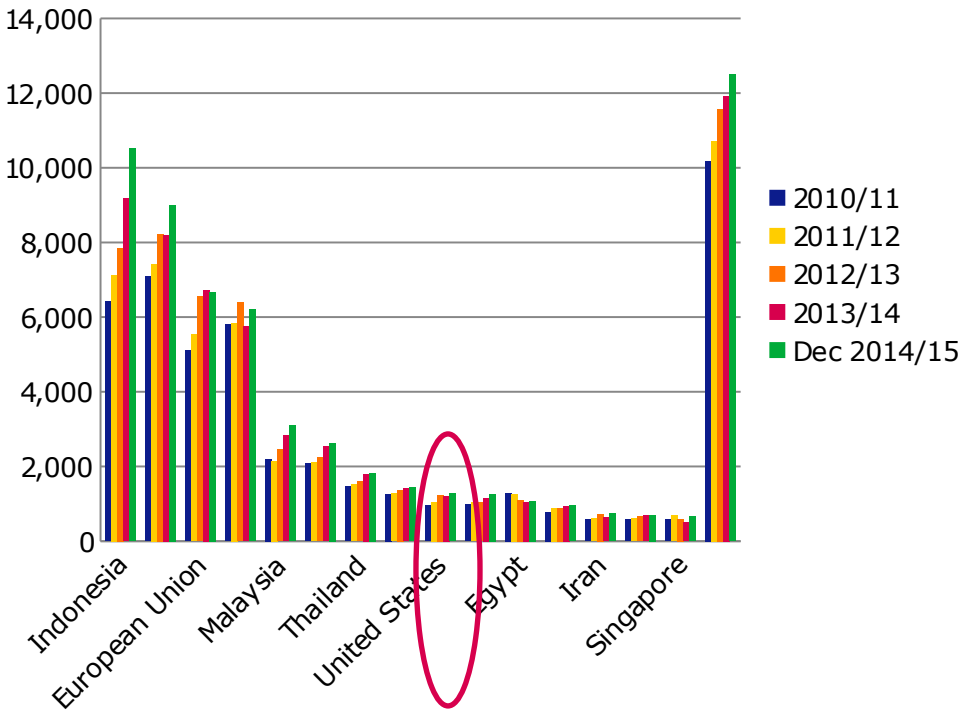


Palm Oil Production and Consumption Trend

Palm Oil Production – '000T



Palm Oil Comsumption – '000T

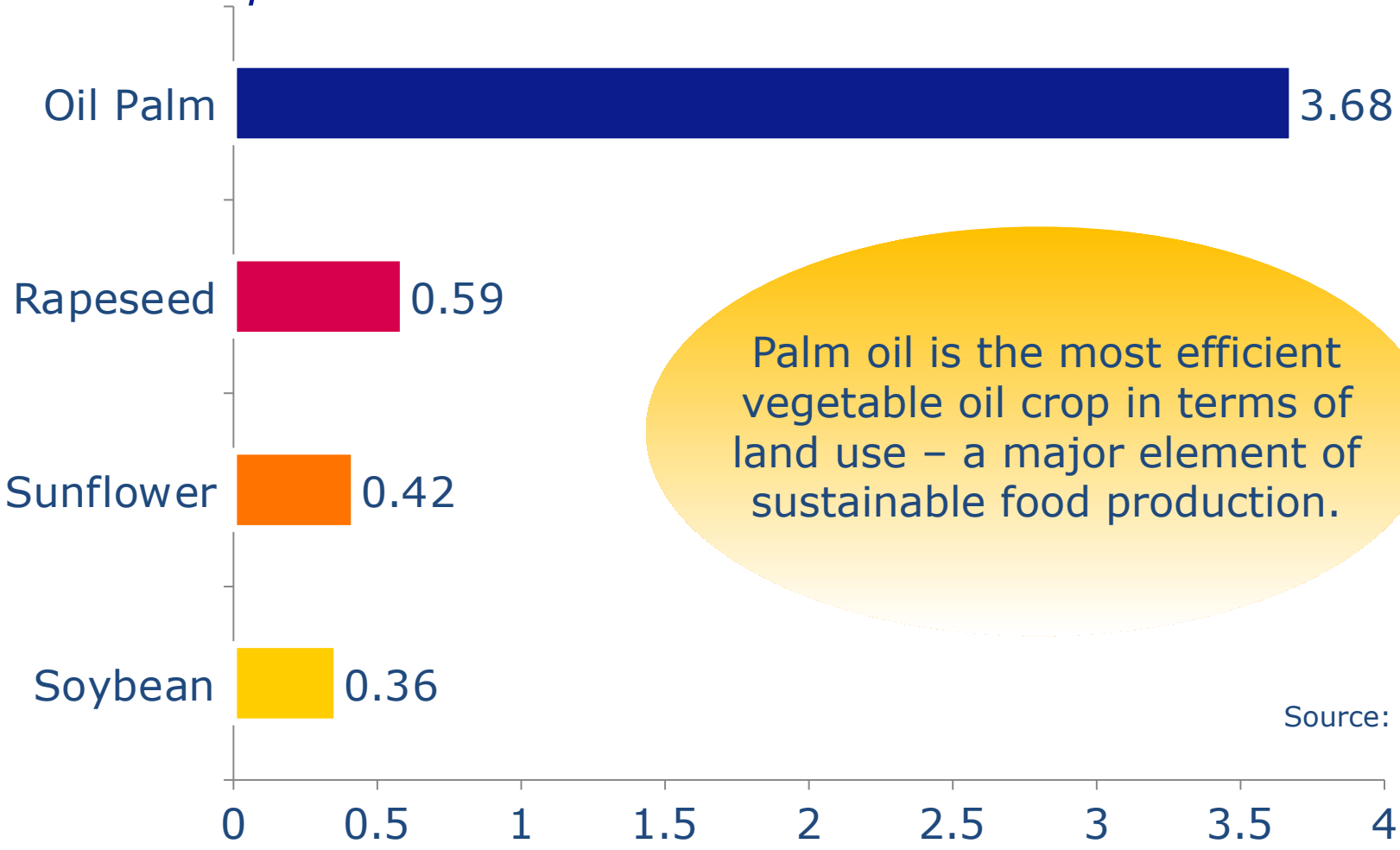


Source USDA - FAS

Why Use Palm Oil?

Average Yield Per Year Per Oil Source

Tons of Oil per Hectare



Palm oil is the most efficient vegetable oil crop in terms of land use – a major element of sustainable food production.

Source: Oil World

Palm Oil and the Environment

Estates can be Developed and Operated in Sustainable Ways

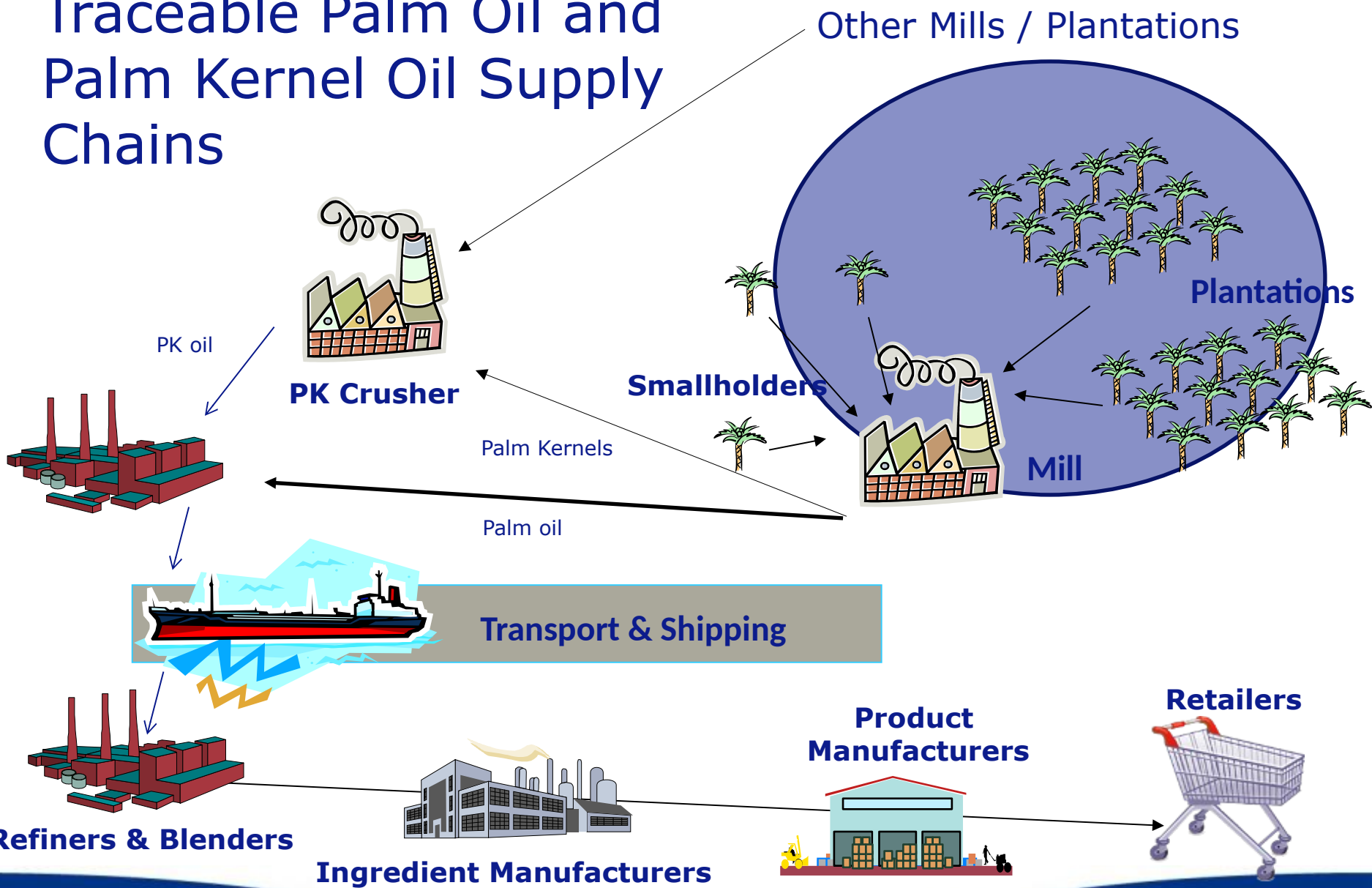
- RSPO, ISCC or equivalent certification. A sustainability standard for growers and processors.
- PLUS
- Avoidance of High Carbon Stock forest.
- No development on peat Land.
- Minimize environmental impact.
- Respect human rights and provide fair and equal employment opportunity driving positive socio-economic impacts.
- AND build Transparent and Traceable supply chains.

RSPO Supply Chain Models

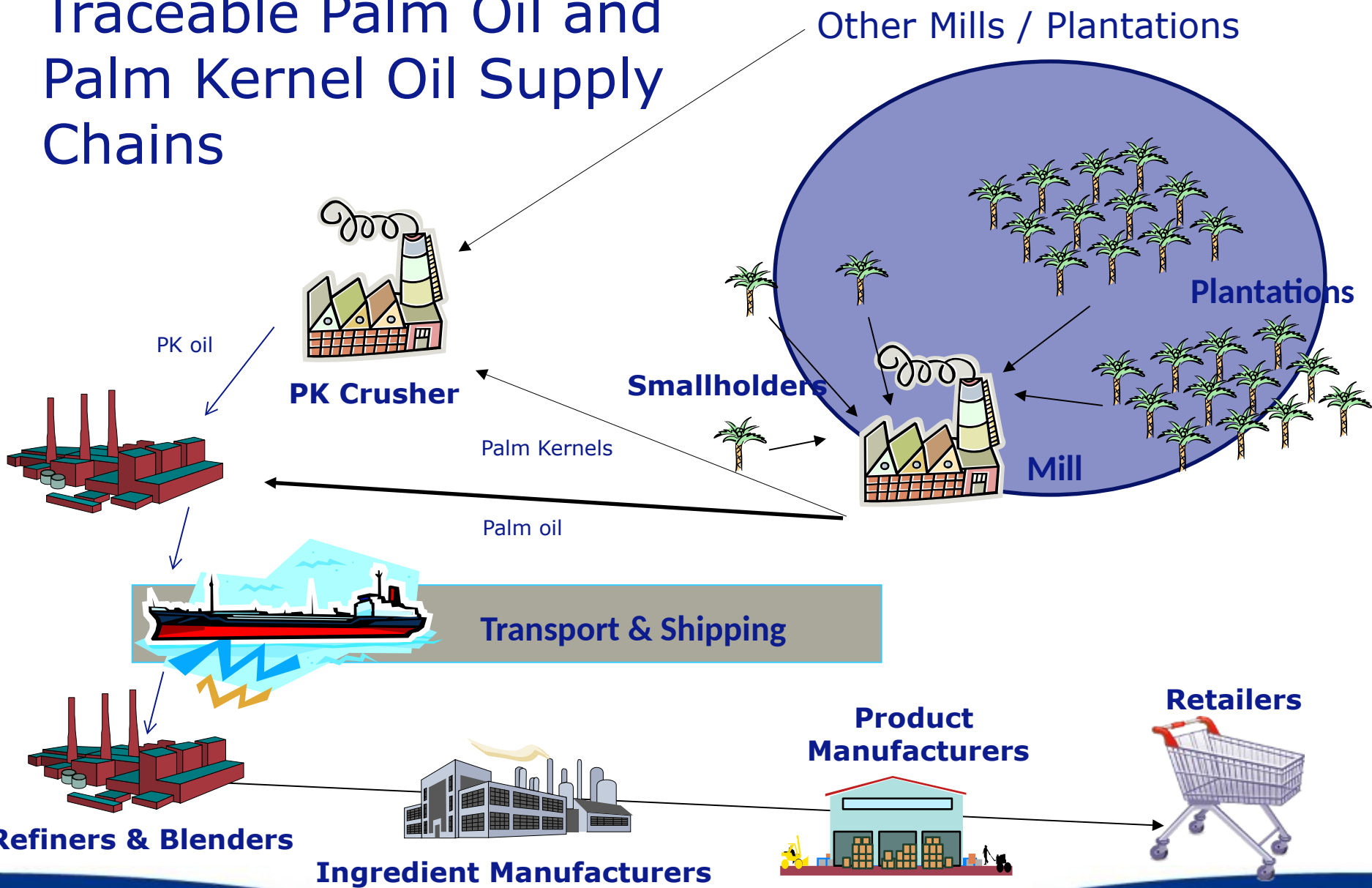
RSPO
Roundtable on Sustainable Palm Oil

- **Certificates / Book & Claim (GreenPalm)**
  - No physical link between certificate and actual consumed oil
- **Mass Balance**
  - Certified palm is mixed with conventional palm
  - "Supports the production of RSPO-certified sustainable palm oil"
  - Costs are higher than certificates
- **Identity Preserved/ Segregated**
  - Certified palm is kept apart throughout the entire supply chain
  - "Contains RSPO-certified sustainable palm oil"
  - Costs are higher than mass balance

Traceable Palm Oil and Palm Kernel Oil Supply Chains



Traceable Palm Oil and Palm Kernel Oil Supply Chains



IOI Loders Croklaan

Sustainable PO Sourcing Practices and Progress

2) What we do. Progress. Q1 2015.

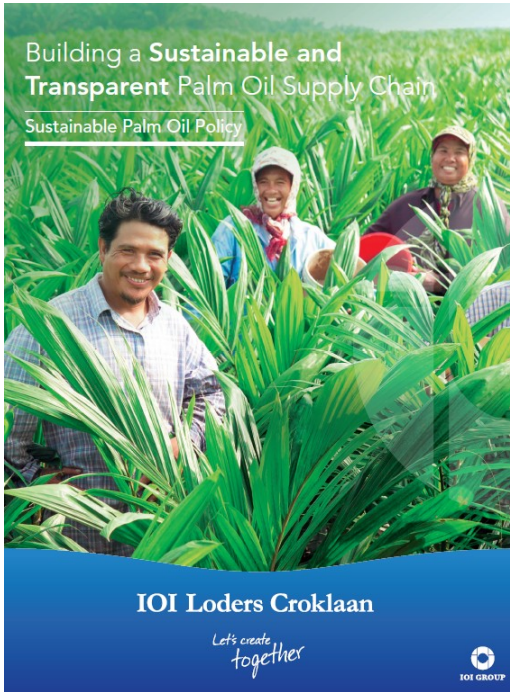
- ✓ Developed and published Palm Oil Sourcing Policy (POSP) and Time Bound Plan for completion
- ✓ Offering all products today certified as RSPO Mass Balance
- ✓ 98% traceable palm oil to mill level
- ✓ 95% traceable PK oil to mill level

3) Next Steps

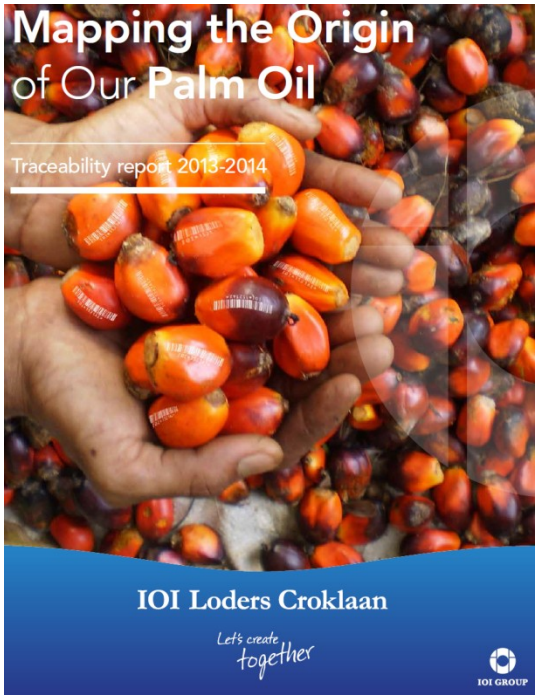
- Working towards traceable and compliant palm oil and PK oil to estate level.
  - Appointment of NGO implementation partner(s)---compliance with the IOILC POSP on the ground.
  - Verifying that the traced supply base minimizes the risk of sourcing non-sustainable oil→ Prioritization.(Remote sensing).
  - Monitoring system (NGO/Internal assessment teams) to verify compliance of suppliers with IOILC POSP covering both environmental and social elements.

IOI Loders Croklaan

Sustainability Goals and Achievements



Sustainable Sourcing Policy

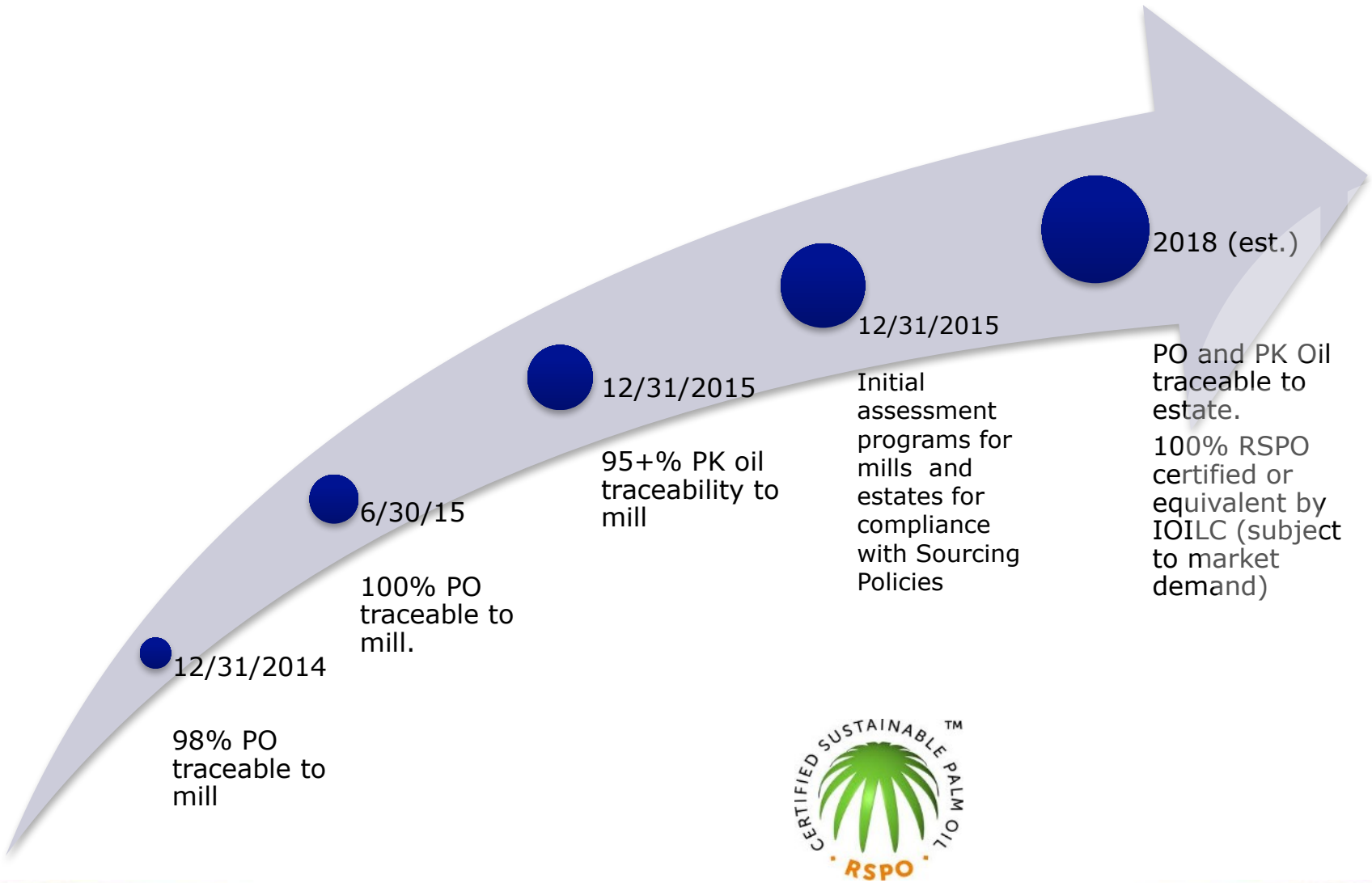


Traceability Report

Time Bound Plan

http://northamerica.croklaan.com/taking-responsibility/sustainable-sourcing//

Palm Oil Time Bound Plan



What Can Palm oil Users Do Today ?

1. Buy 100% CSPO.
   - Physical if possible and certificates where not.
   - Give preference to suppliers with clear commitments.
2. Define an action plan.
   - Time-bound, with interim targets and milestones.
3. Engage Suppliers.
   - Understand their plans for offering CSPO.
4. Require Transparency
   - Provide regular public communications on progress
5. Support Industry Transition.
   - Join RSPO and actively participate in activities to transform the whole industry.

Sustainable Sourcing Guide for Palm Oil Users
May 2015

Research & Development

R&D Functions

- **Staff of 16 Managers, Scientists and Technologists**

- Customer projects
  - Formulation + applications
  - Customized formulations
  - Innovation Projects – long term

- Plant projects
  - Troubleshooting / continuous improvement

- Pilot plant
  - Samples for sales, applications, customer trials

- Launch support for new product introductions

- Training / Technology

5000 sq. ft. Pilot Plant

Pilot scale Votator – 2000 lbs. / day

3 Blending vessels, largest holds 6000 lbs. oil – totes

Glass MPV and two deodorizers

Creative Studio




We work with our preferred customers to improve products on lab scale to cater to your company's needs.

creative studio

- Wormerveer, NL — Opened June 2010
- Pasir Gudang, MY — Opened March 2011
- Channahon, USA — Opened September 2013

IOI Loders Croklaan

Creative Studio

Concept

- The Creative Studio is the place to **dream up new bakery & confectionery products**, prepare them on an artisanal level and **translate** them into **industrial formulations**, all in a short period of time, thereby accelerating our customers product innovation

Activities:

- Proactive Theme Workshops
- Idea Generation Workshops
- Product Based Workshops

Unique:

- The unique set up of the Creative Studio combines **innovation, creativity and specific oils & fats expertise** and makes a logic partner for new product development


Let's create
together