

The complexities of edible fats  
and oils used by the food, and  
five scenarios for the replacement  
of trans fatty acids

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# Author's Disclosures

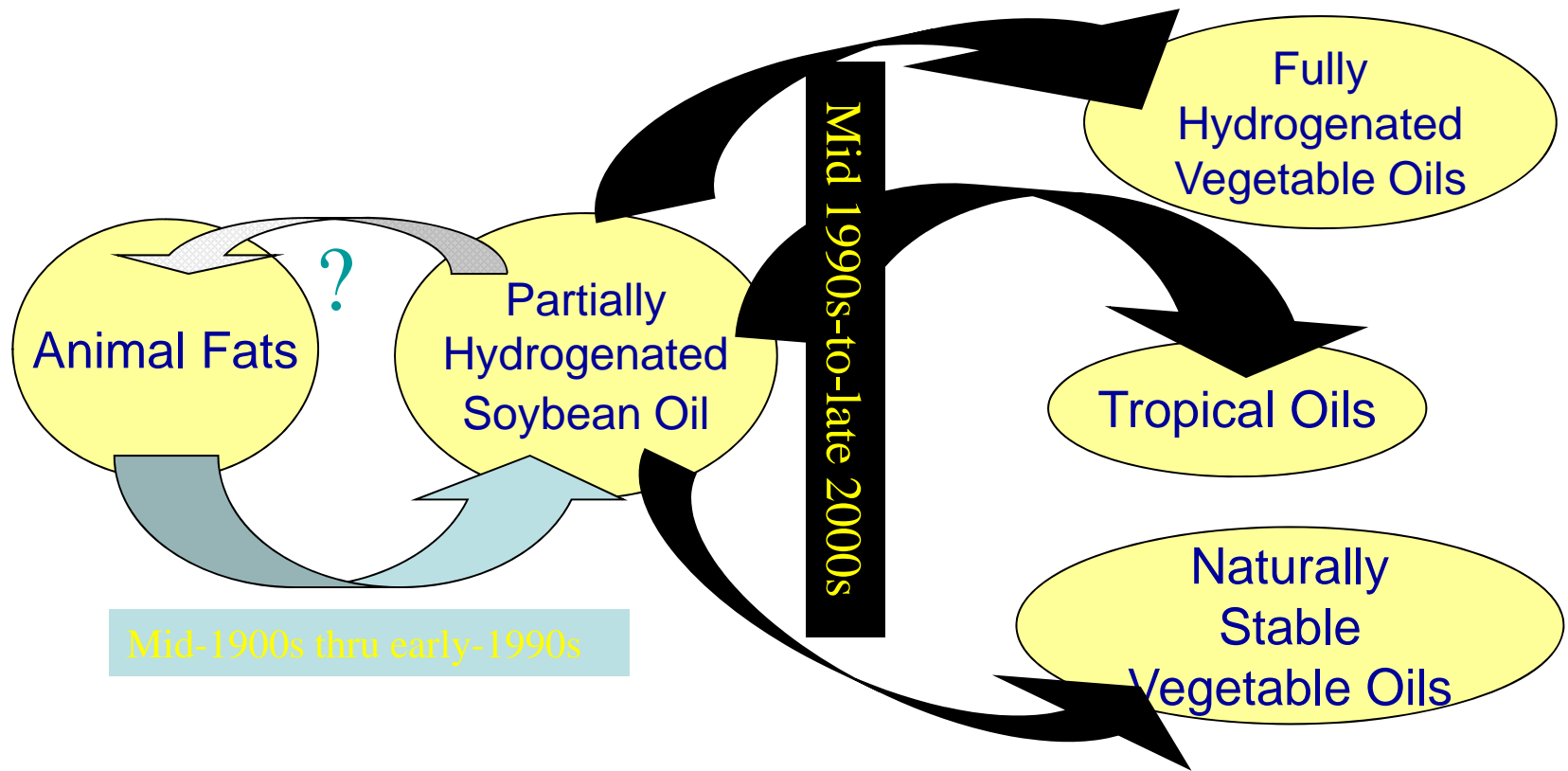
- Employed by Archer Daniels Midland Company
- Serves as Chairperson for ILSI Dietary Lipids Committee which currently has participants representing
  - ConAgra, General Mills, Kraft, Monsanto, Nestle, ADM, Hershey, Sara Lee, Cognis, Masterfoods USA/Mars

# Presentation Outline

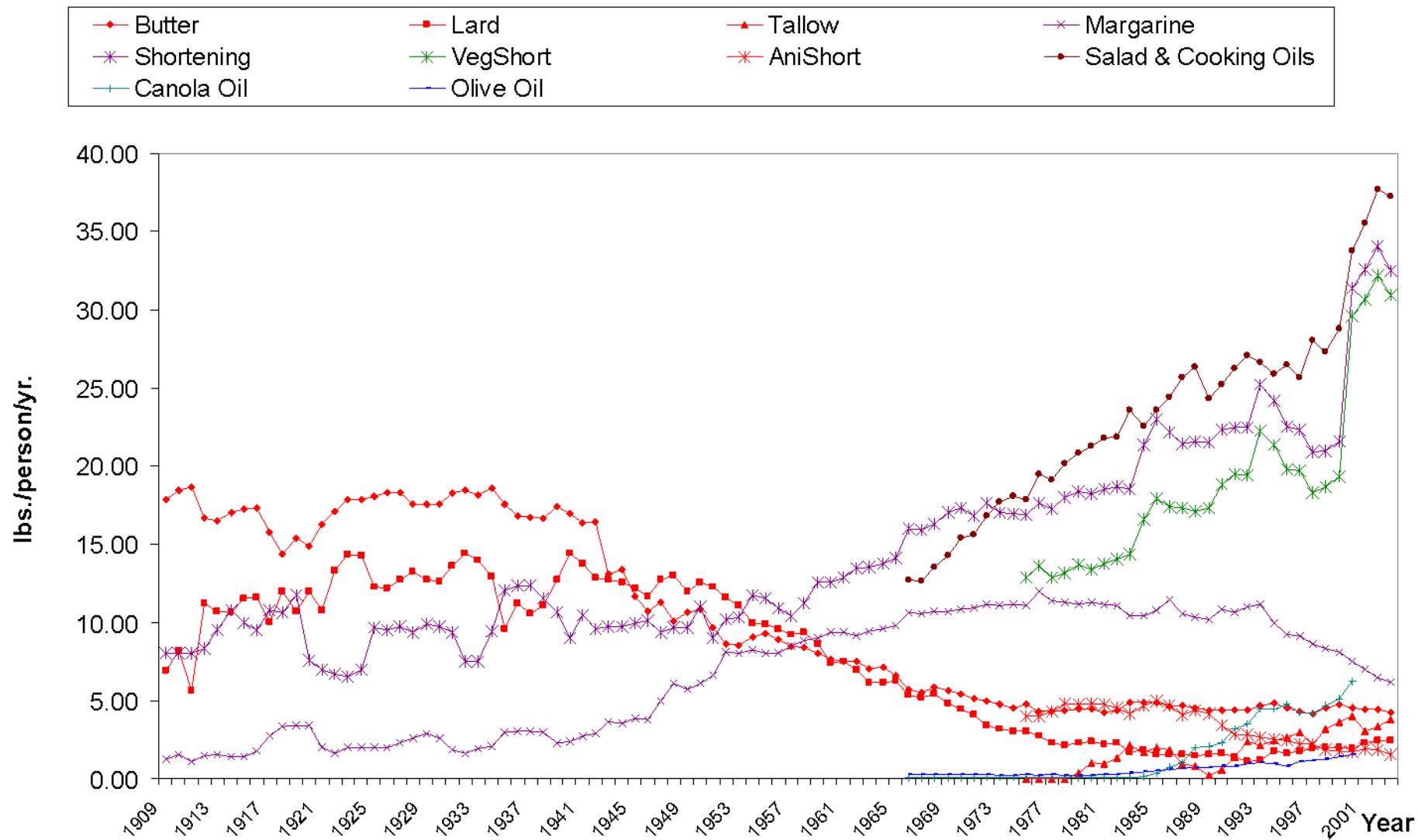
- Edible Fats and Oils in the Food Industry
  - Physical Considerations
  - Functional Considerations
  - Nutritional Considerations
  - Supply & Availability
- ILSI Trans Alternatives Project
  - Overview
  - The Five Theoretical Scenarios

# Baking, Spread and Frying Fats

## *Recent Historical Perspective*

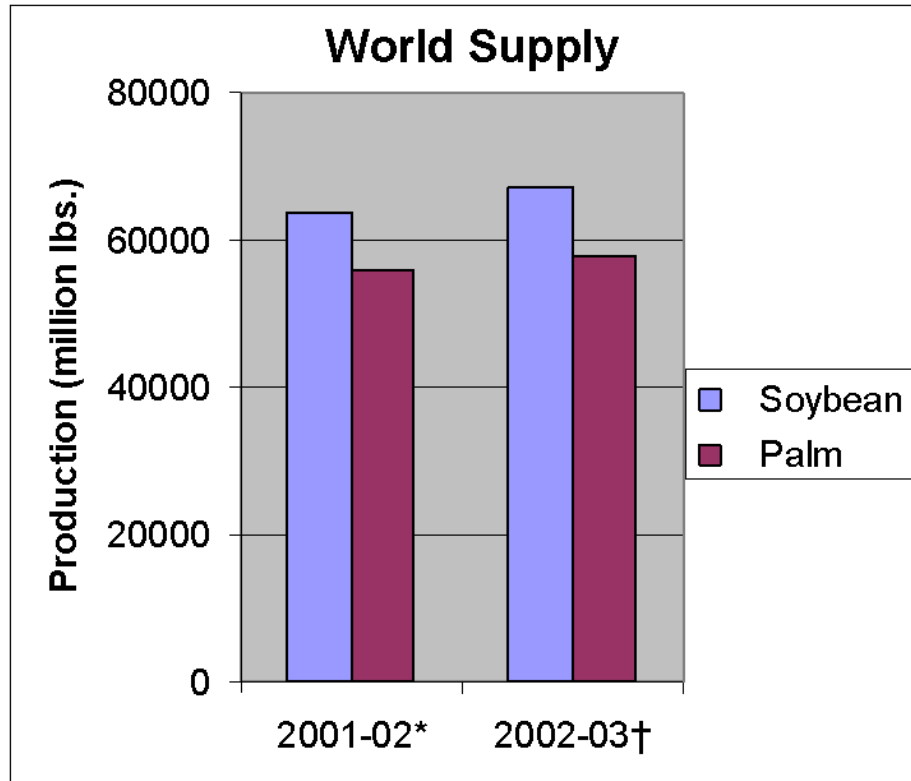


# Per Capita U.S. Edible Fats Food Disappearance



# Manufacturing Food Ingredients

## *Supply Considerations*



- Palm considerations
  - Economics
  - Functionality
  - Availability
  - U.S. logistical network operational and expanding
  - Label “friendly”
  - Nutritional profile

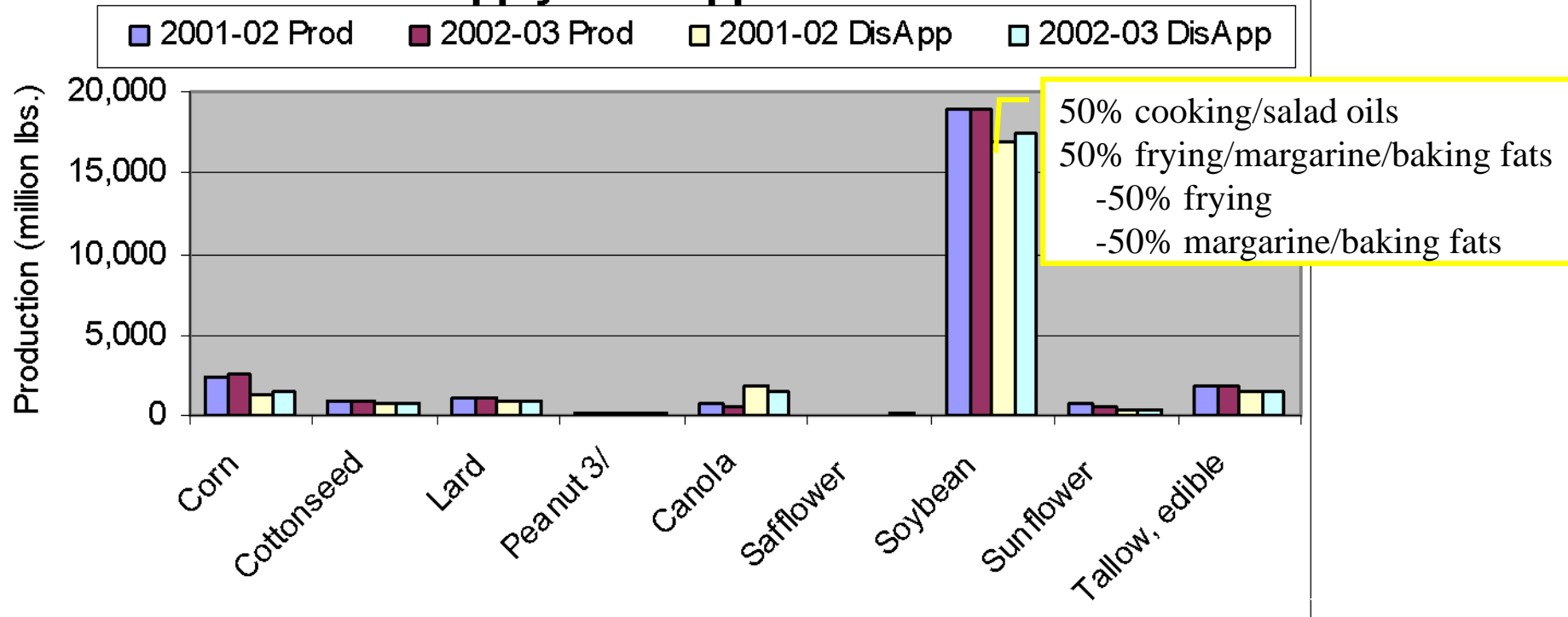
Note: Totals may not add due to rounding. \*Preliminary. †Forecast as of June 2003 1/ Palm oil trade excludes transshipments through Singapore. Source: Counselor and Attache Reports, Official

Statistics, USDA Estimates, June 2003, USDA Foreign Agricultural Service, Cotton, Oilseeds, Tobacco and Seeds Division

# Manufacturing Food Ingredients

## *Supply Considerations*

### U.S. Edible Fats & Oils: Supply & Disappearance



1/ Preliminary and estimated. 2/ ERS and WAOB forecast. 3/ August-July year beginning 1982. 4/ Lard, corn oil, tallow exports are net of imports.

Source: Bureau of the Census, USDA ERS, June 2003

Source: Bureau of the Census

# Technological Options

- Naturally Stable Oils
  - Corn, Cottonseed, Palm, Sunflower
- “Trait Enhanced” Oils (*Modification of fatty acid profile from traditional fatty acid profile*)
  - Features and benefits
    - Good oxidative stability ( $18:3 < 18:2 \ll 18:1$ )
    - Suitable for frying, spray, and some bakery applications
    - Excellent nutritional profile and label appeal relative to partially hydrogenated oils

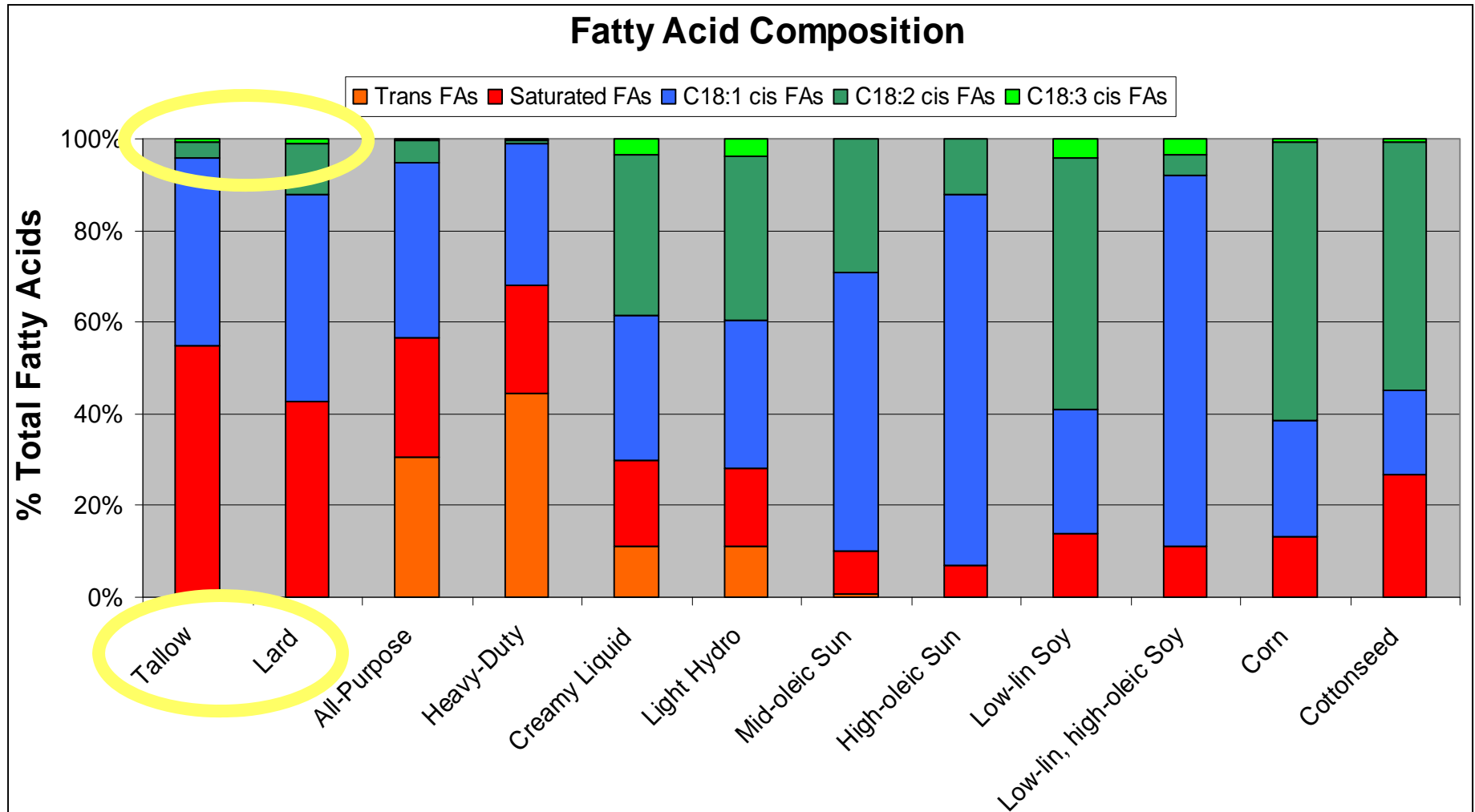
# “Trait Enhanced” Oils

## *Overview*

- Typical PUFA contents of selected seed oils
  - Canola: 21% 18:2 9% 18:3
  - Soybean: 54% 18:2 8% 18:3
  - Sunflower 68% 18:2 1% 18:3
- Categories and examples of TE oils
  - Mid oleic: sunflower (NuSun), soybean
  - High oleic: sunflower, canola
  - Low linolenic: canola (Natreon), soybean (Nutrium, Vistive)

# Frying Fats & Oils

## *Linolenic Acid Content*



# Edible Oils

## *On the Horizon?*

- Emphasis for potential trait-enhanced oils
  - Tocopherols
  - Saturated fatty acids
  - Omega-3 fatty acids

# “Trait Enhanced” Oils

## *Overview*

- Challenges
  - Price
  - Availability (time to commercialize and market acceptance)
  - Production economics (yield and agronomic equality)
  - Preserving “trait” integrity in current commodity system (IP)

# Palm Oil

- Offers versatile solutions for creating shortenings and margarines
  - Palm oil
    - Palm olein fraction
    - Palm stearin fraction
    - Palm mid-fractions
    - Double-fractionated palm olein
  - Palm kernel
    - Palm kernel stearin

# Hydrogenation

- Equivalent low trans products possible but these products will be different analytically since saturates now contribute the solids.

*IV, %Trans, %Saturates of soybean oil hydrogenated to varying degrees*

Iodine Value	% Trans	% Saturates
130	0	14
110	6	14
68	26	23
55	45	33
15	1.5	82
5	0	92

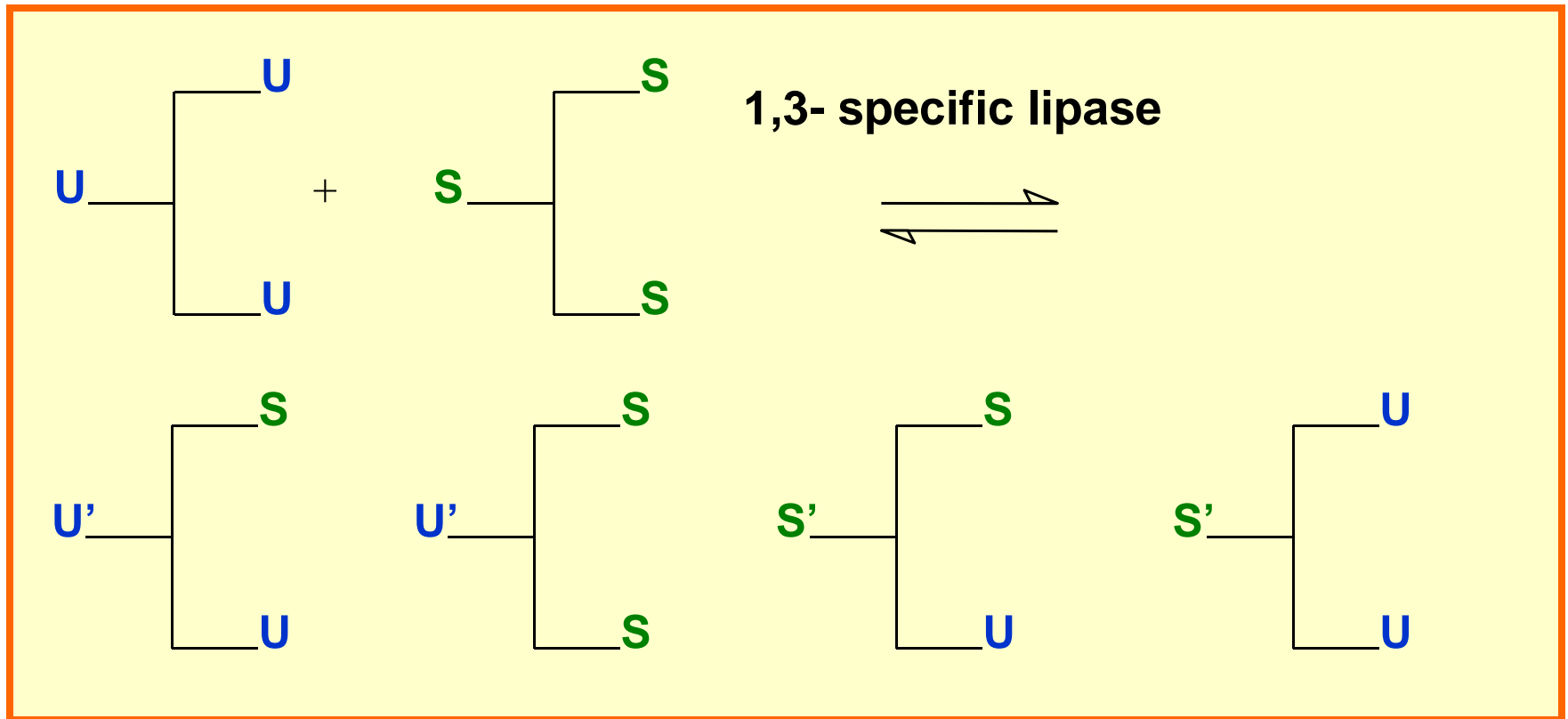
Fully hydrogenated domestic vegetable oils yield 80%+ stearic acid.

# Interesterification

## *Process Description*

- Typical products
  - U.S.: Cocoa butter substitutes and lard.
  - E.U.: Cocoa butter substitutes, margarines and shortenings.
- Methods for interesterification:
  - Chemical: Rearrangement catalyst, random distribution
  - Enzyme (lipase): Continuous process, directed distribution

# Enzyme Interesterification

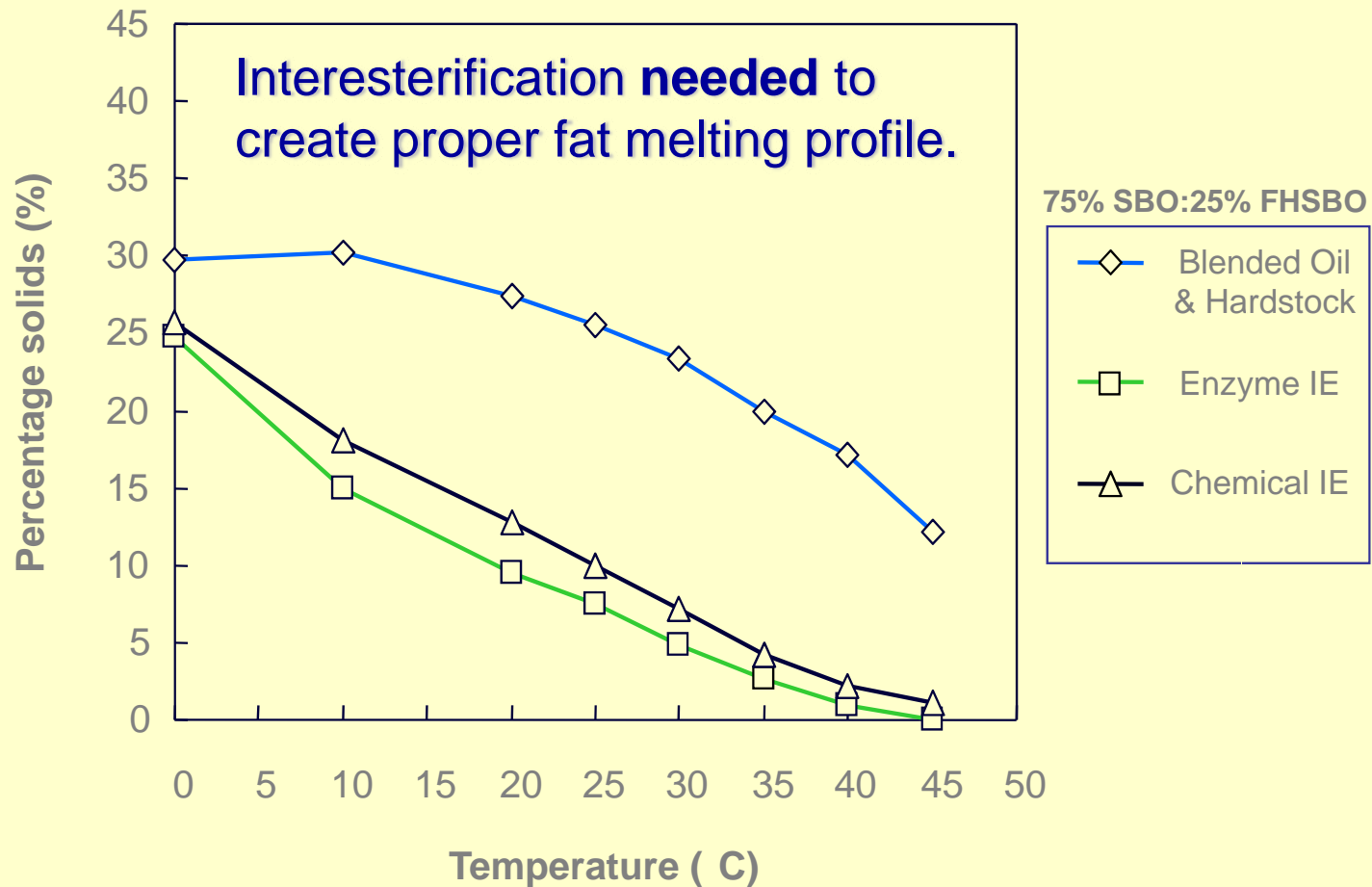


U = Unsaturated fatty acid, S = Saturated fatty acid.

' = conserved position on glyceride backbone.

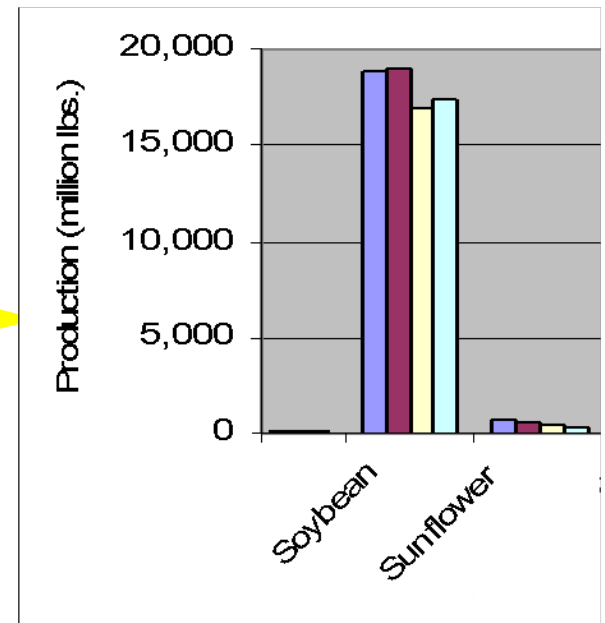
# Solid Fat Content

## Effect of Interesterification



# Marketplace

- Numerous factors will influence marketplace
  - Availability
    - Time to commercialize and market acceptance



# Marketplace

- Numerous factors will influence marketplace
  - Availability
    - Price
    - Production economics: yield and agronomic equality
  - Functionality
  - Consumer acceptance/perception
  - Media coverage

# Marketplace

- Numerous factors will influence marketplace
  - Commodity and manufacturing infrastructures
    - Preserving “trait” integrity in current commodity system (IP)
  - Nutritional aspects
    - Saturated fat intake: amount and type
    - Omega-6 intake
    - Omega-3 intake: amount and type

# Zero Trans Reformulated Products

## *Functional Fat*



### Ingredients

Enriched flour (wheat flour, niacin, reduced iron, thiamine mononitrate {vitamin B1}, riboflavin {vitamin B2}, folic acid), sugar, **palm oil, high oleic canola oil**, dextrose, high fructose corn syrup, salt, cornstarch, baking soda, natural and artificial flavor, soy lecithin (emulsifier)



### Ingredients

Sugar, enriched flour (wheat flour, niacin, reduced iron, thiamine mononitrate [vitamin B1], riboflavin [vitamin B2], folic acid), **high oleic canola oil**, cocoa (processed with alkali), glycerin, **palm oil**, high fructose corn syrup, fructose, emulsifiers (soy lecithin, polyglycerol esters of fatty acids, acetylated monoglycerides, mono- and diglycerides, diacetyl tartaric acid esters of mono- and diglycerides), cornstarch, baking soda, salt, natural and artificial flavor, chocolate



### Ingredients

**Sunflower oil, soybean oil, fully hydrogenated cottonseed oil, mono- and diglycerides**

# Zero *Trans* Reformulated Products

## *Functional Fats*



### Ingredients

Black And White Cookies: unbleached enriched wheatflour (flour, niacin, reduced iron, thiamin mononitrate (vitamin B1), riboflavin (vitamin B2), folic acid), semi-sweet chocolate (sugar, chocolate liquor, cocoa butter, chocolate liquor processed with alkali (dutch), milk fat, soy lecithin added as an emulsifier, vanilla extract ), sugar, vegetable oils (**palm** and/or **interesterified and hydrogenated soybean** and/or **hydrogenated cottonseed**), nonfat milk, whole eggs, contains 2% or less of: cornstarch, cocoa processed with alkali (dutch), chocolate liquor, salt, egg whites, dextrose, baking soda, natural flavors and soy lecithin



### Ingredients

Vegetable oil blend (**liquid corn oil, liquid soybean oil, partially hydrogenated soybean oil and hydrogenated soybean oil**), whey, water, salt, vegetable mono- and diglycerides and soy lecithin (emulsifiers), potassium sorbate and sodium benzoate (to preserve freshness), phosphoric acid (acidulant), artificial flavor, vitamin A palmitate, colored with beta carotene (source of vitamin A), vitamin D3 added. Contains: Milk.

# Project Overview

- ILSI Lipids Committee
- History of Trans Alternatives Project
- Project Timeline
- Today's Objectives

# Trans Alternatives

- In place of PHSBO ingredients,

