A GOOD THING JUST GOT BETTER: SOYBEAN OILS THAT CAN OFFER NUTRITION AND FUNCTIONAL SOLUTIONS

2011 Soybean Breeders Workshop

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Omega-3 Program Lead
Monsanto Company
U.S. Vegetable Oil Consumption Increased 5.3%, While Soybean Oil Share Decreased 27% (2002-2009)

Decline in Food Oil Market Share Results in Reduced Soybean Value
Improved Oils Pipeline Can Help Meet Recent Dietary Guideline Recommendations

2010 DGAC Recommendations

- Reduce Saturated Fat
- Avoid Industrial Trans Fat
- Consume LC sources of Omega-3

Implications

- Reduce to less than 7% en.
- Substitute with MUFA and PUFA
- Substitute with MUFA and PUFA
- Consume 2-4 oz. servings of fatty fish/week
- Average of 250mg LC PUFA/week

Pipeline Soybean Products

- Vistive® Gold Low Saturate High Oleic Low Linolenic Soybean Oil
- Soymega™ SDA Omega-3 Soybean Oil
Stearidonic Acid (SDA) Omega-3 Soybeans

Collaborative Partner: Solae, LLC
Development Phase: Phase 4
Market Focus: Food

Fatty Acid Composition:

<table>
<thead>
<tr>
<th></th>
<th>C16:0 Palmitic</th>
<th>C18:0 Stearic</th>
<th>C18:1 Oleic</th>
<th>C18:2 Linoleic</th>
<th>C18:3n6 γ-Linolenic</th>
<th>C18:3 Linolenic</th>
<th>C18:4n3 Stearidonic</th>
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</thead>
<tbody>
<tr>
<td>Commodity Soybean</td>
<td>11</td>
<td>4</td>
<td>24</td>
<td>52</td>
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<td>8</td>
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<tr>
<td>SDA Omega-3 Soybean</td>
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<td>4</td>
<td>20</td>
<td>24</td>
<td>6</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

Key Benefits:
- Optimal omega-3 for food
- Readily converts to EPA
- Excellent taste and stability
- Can be added to a broad range of food products
- Provides consumers with desirable heart healthy foods
Producing SDA-Omega 3 in Soybeans a Better Solution

Dietary EPA has been demonstrated in clinical trials to benefit heart health*

SDA Omega-3: Nutrition Benefits
Both SDA and EPA Result in a Rise in %EPA

• James et al. 2003 found differential increases in EPA content in plasma lipids and RBC membranes
  14 (ALA) ~ 3 (SDA) ~ 1 (EPA)
• Recent clinical study demonstrates SDA conversion to EPA at significantly higher levels than ALA
• In a high triglyceride sub-population, fasting triglycerides were reduced

Mean (+ SEM) for per protocol population of 157 subjects
• p<0.001 compared to soy oil control; delta for SDA and EPA not different
  p=0.101; ANCOVA
Monsanto Data
## SDA Omega-3: Product Benefits

### Potential Broad Range of Applications

<table>
<thead>
<tr>
<th>Beverages</th>
<th>Baking</th>
<th>Snack Foods</th>
<th>Prepared Foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy Milk/Smoothies</td>
<td>Breads</td>
<td>Granola/Cereal Bars</td>
<td>Processed Meats</td>
</tr>
<tr>
<td>Fruit Juices/Drinks</td>
<td>Muffins</td>
<td>Nutritional Bars</td>
<td>Processed Fish</td>
</tr>
<tr>
<td>Vegetable Juices/Drinks</td>
<td>Cookies/Crackers</td>
<td>Snacks</td>
<td>Entrees/Sides</td>
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<tr>
<td>Enhanced Waters</td>
<td>Pastries/Cakes</td>
<td>Confectionery</td>
<td>Soups/Sauces</td>
</tr>
<tr>
<td></td>
<td>Baked Cereal Bars</td>
<td></td>
<td>Pet Foods</td>
</tr>
</tbody>
</table>

- Conventional soybean processing
- Clean, neutral oil taste
- Oil stability improved vs. other omega-3 oils
- Broad range of food applications
- Maintain traditional flavor and shelf life
SDA Omega-3: Product Benefits
Granola Bar Shelf Life Results

- Granola Bar shelf life study demonstrated SDA and the control were lower than all other omega-3 oils for off flavor, and off aftertaste throughout the 12 month study.

- Similar results have been found across a range of applications including spreads, salad dressings, yogurt, dairy drinks, soy milk, baked cereal bars

- The SDA enriched granola bar exhibited the least quality change at 12 months compared to all other prototypes.

**Nut and Berry Granola Bar Total Off Flavor - 12 mos.**

<table>
<thead>
<tr>
<th></th>
<th>12 mos</th>
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<tbody>
<tr>
<td>Soy Oil</td>
<td>3.5</td>
</tr>
<tr>
<td>SDA-Enriched Soy Oil</td>
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</tr>
<tr>
<td>Flax</td>
<td>4.0</td>
</tr>
<tr>
<td>Algal</td>
<td>5.0</td>
</tr>
<tr>
<td>Fish</td>
<td>5.0</td>
</tr>
<tr>
<td>Encap. Fish</td>
<td>7.5</td>
</tr>
</tbody>
</table>

15 point descriptive scale  
n=5 trained panelists  
12 month shelf life  
Ambient storage

**Enrichment levels:**  
SDA: 375mg SDA/42 gram bar  
Fish/Algal: 120 mg EPA/DHA/42 gram bar

Monsanto Data
SDA Omega-3: Product Benefits

- Consumer acceptance testing across a range of food products enriched with SDA Omega-3, there is equal consumer acceptance for overall liking and flavor.

- SDA provides the opportunity to develop foods with acceptable taste and shelf life.

![Graph showing consumer acceptance overall liking for various products](image)

Hedonic Rating

Consumer Acceptance
Overall Liking

- Yogurt: 7.07 a, 6.6 a
- Yogurt Drink: 7.14 a, 7.14 a
- Granola Bars: 6.6 a, 6.47 a
- Spreads: 6.59 a, 6.53 a
- Mayonnaise: 7.3 a, 7.05 a

Monsanto Data

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Vistive® Gold Low Saturate/High Oleic/Low Linolenic Soybeans

Development Phase: **Phase 4 (prelaunch)**
Market Focus: **Food**

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<tr>
<td>Low Saturate High Oleic Soybean</td>
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<td>3</td>
<td>68-74</td>
<td>15</td>
<td>&lt;3</td>
</tr>
</tbody>
</table>

- **Reduced Saturates**
- **Improved Stability**

**Nutritional Benefits**
- 0g *trans* fats
- Lowest sat fat of soybean oils

**Functional Benefits**
- Excellent flavor
- High stability
- Eliminates polymer buildup

**Targeted Use**
- Frying
- Spray for crackers/snacks
- Baking blends

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BENEFITS

Improved Oxidative Stability

- Vistive® Gold shows significantly lower Oxidative Stability Index compared to other oils.

Vistive® Gold is Significantly Lower in Saturated Fat

- Vistive® Gold contains significantly lower saturated fat compared to other oils.

Improved Oil Fry Life

- Vistive® Gold has the longest fry life at 90 hours.
- High Oleic Low Lin Canola has a fry life of 85 hours.
- Fry Shortening has a fry life of 85 hours.
- Vistive Low Lin has a fry life of 68 hours.
- Soybean Oil has a fry life of 55 hours.

Reduced Polymer Buildup During Frying

- Vistive Gold shows reduced polymer buildup.
- Vistive I shows reduced polymer buildup.
- Commodity shows increased polymer buildup.

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"The greatest danger for most of us is not that our aim is too high and we miss it, but that it is too low and we reach it."

Michelangelo
**Vistive® Gold** low saturate high oleic soybeans and SDA omega-3 soybeans are not commercial. Commercialization is dependent on several factors including successful conclusion of the regulatory process.

SDA omega-3 soybean oil will be commercialized as **Soymega™**. **Soymega** is a trademark of Solae, LLC.

*Monsanto, the vine design and Vistive®* is a registered trademark of Monsanto Company