Opportunities and Challenges
Commercializing Quality Traits

David M. Stark, Ph.D.
Vice President, Global Trade Partnerships
Monsanto Company
Monsanto is 100% Focused on Agriculture

Monsanto Company is a leading global provider of technology-based tools and agricultural products that improve farm productivity and food quality.

Our Mission

• Meet the world’s growing food needs
• Conserve natural resources
• Protect the environment
• Improve Lives

“We succeed when farmers succeed.”
Monsanto Global Recognitions
Fresh Produce Value Chain – US Market

$122B Consumers
$69.2B Retail
$51.1B Foodservice
$26.8B Farmgate
$500M Seed

2010, Roberta Cook
Two main approaches to health and nutrition
Improved Potato Solids Concept:
*Lower fat, better quality and flavor fries and chips*

**Potato Tuber Cross-Sections of Improved Solids Uniformity Russet Burbank Lines**

**Top Row:**
Tubers from 3 transgenic Russet Burbank lines: expressing solids uniformity

**Bottom Row:**
Tubers from unimproved Russet Burbank.
Anti-Bruise Technology

Anti-Bruise Russet Burbank Line

Bruise Susceptible Russet Burbank Line
DON'T YOU SELL ANYTHING WITHOUT THE DREADED TRANS FATTY ACIDS?

SURE... WE SELL CIGARETTES!
WHO targets a trans fat-free Europe

By Caroline Scott-Thomas, 19-Sep-2014
The World Health Organization (WHO) has called for a complete ban on trans fats throughout Europe as part of a new action plan on diet and health.

http://www.foodnavigator.com/Legislation/WHO-targets-a-trans-fat-free-Europe
Industry Challenge

Before Trans Fat

One soybean
One oil

Hydrogenation

After Trans Fat

Several soybeans
Several oils

All ‘soybean oil’, but each one is different
Soybean Oil Share of US Food Market

U.S. Annual Lbs Oil Consumed per Person

<table>
<thead>
<tr>
<th>Year</th>
<th>All Vegetable Oils</th>
<th>Soybean Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>82%</td>
<td>75%</td>
</tr>
<tr>
<td>2003</td>
<td>59%</td>
<td>61%</td>
</tr>
<tr>
<td>2004</td>
<td>53%</td>
<td>59%</td>
</tr>
<tr>
<td>2005</td>
<td>51%</td>
<td>53%</td>
</tr>
<tr>
<td>2006</td>
<td>49%</td>
<td>51%</td>
</tr>
<tr>
<td>2007</td>
<td>48%</td>
<td>49%</td>
</tr>
<tr>
<td>2008</td>
<td>44%</td>
<td>48%</td>
</tr>
<tr>
<td>2009</td>
<td>55%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Trans Fat Legislation
Vistive low lin

Vistive Gold
(high oleic, low lin)

18:2 18:1 18:3 Sats

54% 15% 8% 18:3 23%

15%

26% 3% 15%

56%
Supply chain challenges; seed production decisions made several years in advance of oil supply – Not *Just-In-Time*!

**2009 delivery of oil**

- Farmers contracted by Feb. ’08
- Seed production contracts finalized March ‘07
- Seed decision Sept. ‘06 (normal cycle)
Low Linolenic Soy

Overall not a success

- Limited value (oil life, polymerization, cost)
- Slow, expensive grower adoption
- Yield drag in early years
- Volume limited; supply not reliable
- Food co reformulation costs

✔ Built IDP system
### Fatty Acid Composition

<table>
<thead>
<tr>
<th>Oil Type</th>
<th>Saturates</th>
<th>Monounsaturates</th>
<th>Linoleic Acid</th>
<th>Linolenic Acid</th>
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</thead>
<tbody>
<tr>
<td>Vistive Gold Hi Oleic Soybean Oil</td>
<td>6.9</td>
<td>7.1</td>
<td>16.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Hi Oleic / Lo Lin Canola Oil</td>
<td>7.1</td>
<td>7.2</td>
<td>16</td>
<td>16.1</td>
</tr>
<tr>
<td>Canola Oil</td>
<td>7.2</td>
<td>9.5</td>
<td>19.6</td>
<td>9.5</td>
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<tr>
<td>Hi Oleic Sunflower Oil</td>
<td>9.5</td>
<td>9.7</td>
<td>26.8</td>
<td>10.1</td>
</tr>
<tr>
<td>Nusun Mid Oleic Sunflower Oil</td>
<td>9.7</td>
<td>10</td>
<td>16.5</td>
<td>19.6</td>
</tr>
<tr>
<td>Safflower Oil</td>
<td>10</td>
<td>14.5</td>
<td>75</td>
<td>19.5</td>
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<tr>
<td>Sunflower Oil</td>
<td>12</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Plenish Hi Oleic Soybean Oil</td>
<td>12</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
</tr>
<tr>
<td>Corn Oil</td>
<td>13</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Olive Oil</td>
<td>14</td>
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<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Soybean Oil</td>
<td>15</td>
<td>16.5</td>
<td>70.5</td>
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<tr>
<td>Peanut Oil</td>
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<td>Cottonseed Oil</td>
<td>17</td>
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<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Lard</td>
<td>18</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Palm Olein</td>
<td>19</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Beef Tallow</td>
<td>20</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Palm Oil</td>
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<tr>
<td>Palm Stearine</td>
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<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Palm Kernel Oil</td>
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<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
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<tr>
<td>Coconut Oil</td>
<td>24</td>
<td>16.5</td>
<td>70.5</td>
<td>19.5</td>
</tr>
</tbody>
</table>
90% reduction in saturated fat and trans fat*. 3.5 oz serving of French fries with 8 fewer grams of bad fat’s.

- great performance, oil life, flavor
- becoming more cost competitive
- grower adoption

*Versus hydrogenated oils
High Oleic Oils... 

...a success
• 26.3% American adults ≥ 3 vegetables (2009)
  – Down 0.4 points from 2000

• 32.5% American adults ≥ 2 fruit (2009)
  – Down 1.9 points from 2000

• In Europe, 2008 vegetable consumption decreased 14.2% vs. last 5 year average (based on supply)

“Most people, regardless of the country that they live in, simply do not meet the recommended guidelines for fruit and vegetable consumption.” J.N. Hall, Am J Prev Med 2009

School Meals

<table>
<thead>
<tr>
<th>Haas et al</th>
<th>% Selected</th>
<th>% Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrée</td>
<td>100</td>
<td>12</td>
</tr>
<tr>
<td>Canned Fruit</td>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td>Fresh Fruit</td>
<td>42</td>
<td>22</td>
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<tr>
<td>Vegetable</td>
<td>20</td>
<td>29</td>
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</table>

<table>
<thead>
<tr>
<th>Monsanto</th>
<th>% Unsold</th>
<th>% Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melōränge Melon</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>BellaFina mini-bell peppers</td>
<td>37</td>
<td>5</td>
</tr>
</tbody>
</table>

Haas et al., J. of Child Nutrition and Management, V.38, Issue 1, 2014

“I had a meeting with _ Public Schools today and they cannot find any affordable fresh produce. They are depending on the commodity canned fruit from the government but there is a shortage. “ Sept. 2014
A success
- good agronomics
- right model and partners
- easy consumer benefit
EVERYDAY, THOUSANDS OF INNOCENT PLANTS ARE KILLED

BY VEGETARIANS HELP END THE VIOLENCE.
EverMild™ Sweet

Imported Sweet
A SWEET, HEALTHY SNACK FOR THE WHOLE FAMILY TO ENJOY

GOOD SOURCE OF VITAMIN C & VITAMIN A

Watermelon - 7 Days After Slicing

Summerslice™ - 7 Days After Slicing
A tough one

- Not a recognized nutrient (RDA)
- Not an easy sound bite; health claim
- Business model
- Still promising

A. Gasper et al., J. Nutr., 137 (7), 1718-1724 (2007)
Vegetable Challenges

- Flavor ‘talk’; not always ‘walk’
- Grower adoption
- Buyer inertia
- Quality control
- Merchandising
- ROI
• Quality traits are difficult
• Can’t be ‘quality’ or agronomics
• Pursue shifts, not fads
• Set realistic expectations
• Success is possible!!!