Snack on This: Plant-Based Proteins & Soy

A U.S. Consumer Perspective | 2020
Soybeans Provide a U.S. Grown Solution

Domestic solution for the food industry

Soy protein (conventional & organic)
Soybean oil (conventional & high oleic)

United Soybean Board Support: $90 million over five years

- Support for geographically dispersed acreage
- Support to establish farmer commitment
- Support for crusher, refiner and food industry outreach and promotion
Speakers

Debora Scott, MBA
Partner, Illuminate Research

Michelle Braun, PhD.
Research Scientist at DuPont
Nutrition & Health, DuPont

Frank Flider
Oils Consultant, QUALISOY
Polling Question
What is your perception of soy as an ingredient in packaged food?

Positive  Neutral  Negative
What We Know
Recent Consumer Insights
The Impact of Covid-19

8 in 10 Americans have altered their eating habits. Biggest changes include:

❖ Cooking more at home
❖ Snacking a lot more, but looking for healthy options

The line between “snacking” and “meals” continues to blur:

❖ 25% snack multiple times a day
❖ 33% snack daily
❖ 40% replace meals with snacks at least occasionally

Recent snack trends accelerating:

❖ Single-serve everything - Bone broth
❖ Focus on wellness/nutrition benefits – High protein, gluten-free, low-sugar
❖ More plant-based version of traditional snacks – “Jerky,” non-dairy hot chocolate
❖ Healthy indulgence – High protein non-dairy ice cream
What Consumers Think About Soyfoods?

United Soy Board Consumer Attitudes Tracking Study: January 2019

Nearly three-quarters (74%) currently view soyfoods as “healthy” (40% “very healthy”)

About four in ten (39%) are aware of specific health benefits of including soyfoods in their diets

Over half (54%) of those aware of soy’s health benefits say they specifically seek out soyfoods due to their perceived nutritional benefits
New Research
What We Wanted to Learn
United Soybean Board Plant-based Protein Study, April 2020

1. Quantify the size of the plant-based consumer market, most popular types of products and level of scrutiny consumers have when selecting plant-based products.

2. Identify consumer priorities when choosing plant-based foods, perceptions of soy protein and marketing language that could impact purchase.
Research Findings
A Snapshot View
Current Dietary Habits – Most are “Omnivores”

(Base = Total Responding; n=1,003)

65% of respondents say they eat both animal and plant protein

35% say they eat mostly plant-based protein

QS5: Which of the following statements best describes your current dietary habits?

![Bar Chart:
- 36% (Total)
- 35% Eat mostly plant-based protein
- 29% Eat both plant and animal protein
- 36% Eat mostly animal-based protein

% Responding

Eat mostly animal-based protein
Eat both plant and animal protein
Eat mostly plant-based protein

Late Teens (16-20) 20s (21-29) 30s (30-39) 40s (40-49)
Change in Consumption of Plant-Based Meals vs. Past Two Years
(Base=1,003)

QS6: Which of the following statements best describes you?

<table>
<thead>
<tr>
<th>Eating more</th>
<th>Late Teens</th>
<th>20’s</th>
<th>30’s</th>
<th>40’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating same</td>
<td>58%</td>
<td>61%</td>
<td>60%</td>
<td>64%</td>
</tr>
<tr>
<td>Eating more</td>
<td>42</td>
<td>39</td>
<td>40</td>
<td>36</td>
</tr>
</tbody>
</table>
Just under six in ten (59%) report consuming a non-dairy beverage, a meal replacement/protein bar or a meat alternative at least once in the past month.

*To qualify for this study, respondents must have consumed at least two of the plant-based foods on the list in the past 30 days.

**Q57:** Which of these specific plant-based packaged foods have you consumed in the past month, either at home or away from home?
# Reasons for Incorporating Plant-Based Foods in Diet

(Base=1,003)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve overall health/nutrition</td>
<td>51%</td>
</tr>
<tr>
<td>Improve quality of protein in diet</td>
<td>40</td>
</tr>
<tr>
<td>Help protect environment/sustainability</td>
<td>40</td>
</tr>
<tr>
<td>Help with weight control</td>
<td>39</td>
</tr>
<tr>
<td>Like the taste</td>
<td>37</td>
</tr>
<tr>
<td>Concerned about animal welfare</td>
<td>34</td>
</tr>
<tr>
<td>Increase amount of protein in diet</td>
<td>32</td>
</tr>
<tr>
<td>Prevent illness</td>
<td>28</td>
</tr>
<tr>
<td>Improve sports/fitness/performance</td>
<td>28</td>
</tr>
<tr>
<td>Save money</td>
<td>23</td>
</tr>
<tr>
<td>Address specific health concerns</td>
<td>22</td>
</tr>
</tbody>
</table>

Q3. Which of the following reasons describe why you eat plant-based main dish meals at least occasionally?

#1 - Improve their overall health and nutrition

#2 - Improve protein quality and protect the environment
83% Pay Attention to Plant Protein Source Before Buying
(Base=1,003)

Preferred Plant-based Protein Ingredient
(Base = Pays Attention Before Buying; n=830)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy</td>
<td>19%</td>
</tr>
<tr>
<td>Bean</td>
<td>15</td>
</tr>
<tr>
<td>Wheat (gluten)</td>
<td>15</td>
</tr>
<tr>
<td>Rice</td>
<td>13</td>
</tr>
<tr>
<td>Chickpea</td>
<td>11</td>
</tr>
<tr>
<td>Oat</td>
<td>10</td>
</tr>
<tr>
<td>Peas</td>
<td>9</td>
</tr>
<tr>
<td>Hemp</td>
<td>7</td>
</tr>
<tr>
<td>Another type</td>
<td>1</td>
</tr>
</tbody>
</table>

Soy is among the top preferred plant-based protein ingredients

Q6a: Do you pay attention to the type of plant-based protein used as an ingredient in a prepared or packaged food product before you buy it?
Q6b: Do you have a preferred type of plant-based protein you look for?
Two-thirds (66%) rate soy protein as an ingredient positively.
<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy/Good for you</td>
<td>29%</td>
</tr>
<tr>
<td>Tastes good</td>
<td>17</td>
</tr>
<tr>
<td>Good/Complete protein source</td>
<td>14</td>
</tr>
<tr>
<td>Like it</td>
<td>8</td>
</tr>
<tr>
<td>Good non-meat alternative</td>
<td>6</td>
</tr>
<tr>
<td>Nutritious/High in vitamins</td>
<td>4</td>
</tr>
<tr>
<td>Better than eating meat (animal welfare issues)</td>
<td>4</td>
</tr>
<tr>
<td>Familiar with it</td>
<td>3</td>
</tr>
<tr>
<td>Heard good things</td>
<td>3</td>
</tr>
<tr>
<td>Helps with lactose intolerance</td>
<td>3</td>
</tr>
<tr>
<td>Easy to use/incorporate into diet</td>
<td>2</td>
</tr>
<tr>
<td>Positive for environment/sustainability</td>
<td>2</td>
</tr>
</tbody>
</table>
Preference for a “Complete” Plant-based Protein

(Base = 1,003)

88% say it’s important

8% say it’s not important

4% not sure

Q8: How important is it to you that the plant-based protein you consume be a complete protein? (A complete plant-based protein contains all 9 essential amino acids, offering nutrition comparable to animal-based proteins.)

88% say consuming a “complete” plant-based protein is important

Only 8% say it is not
77% say the type and amount of protein in their plant-based snacks is important
Among options for additional information that could be included on packaging for a plant-based food product, respondents are most interested in specific health claims such as "high in fiber," "high quality..."

Specific health claims such as "high in fiber," "high quality..." 61% Responding

How the key ingredient was processed 52% Responding

Where the key ingredient is grown 45% Responding

Information about the farmer who grew the main ingredient 37% Responding

Other type of information 1% Responding

None of these 5% Responding

Q14a: In addition to the Nutrition Facts Label and ingredient list found on all food product packaging, here is some other information which could be included on the package of a plant-based food product. What information would you like to see on the package?

Q14b: What information is most important to you? Please rank in order of importance.
# Potential Consumer Marketing Language about Plant-based Foods Made from Soy Protein

(Base = 1,033)

<table>
<thead>
<tr>
<th>Message</th>
<th>% Definitely Interested 6, 7 Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>The protein from soybeans is high quality and good for your heart*</td>
<td>52%</td>
</tr>
<tr>
<td>Soy, a complete protein. Good for you and good for the environment</td>
<td>52</td>
</tr>
<tr>
<td>The protein from soybeans is one of the highest quality proteins among all plants</td>
<td>50</td>
</tr>
<tr>
<td>You support U.S. farmers when you choose to eat sustainably grown, protein-rich soy</td>
<td>50</td>
</tr>
<tr>
<td>Protein from soybeans, 100% plant-based and grown by U.S. farmers</td>
<td>48</td>
</tr>
<tr>
<td>Eating protein sourced from U.S. grown soybeans may help you reduce your carbon footprint</td>
<td>48</td>
</tr>
<tr>
<td>Soy is the only protein (plant or meat) that can be called heart healthy*</td>
<td>48</td>
</tr>
<tr>
<td>Soy is a high-quality plant-based protein comparable to meat</td>
<td>47</td>
</tr>
<tr>
<td>Soybeans, a sustainably grown source of plant-based protein</td>
<td>46</td>
</tr>
</tbody>
</table>

*25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease

**Messages with an emphasis on high-quality protein in the combination of benefits appear to be most motivating overall**
Key Findings
Most consumers now eat both animal and plant-based protein meals, and six in ten are eating more plant-based meals vs. two years ago.

Almost six in ten report eating a non-dairy beverage, a meal replacement/protein bar or meat alternative in the past month.

Consumers are paying attention to the source of protein in plant-based packaged foods and prefer “complete” protein such as soy.

High protein snack options are in demand and over three-quarters say the type and amount of protein used in a plant-based snack is important.

Labeling soy ingredients as “U.S. grown” resonates with the nearly half of consumers who would like to see where an ingredient is grown called out on food packaging.

Companies should label and promote soy protein ingredients as “high quality” and “complete” to motivate consumers.
Polling Question

Is your company currently using soy ingredients?

Yes       No
Plant protein sources: production, sustainability, functionality, nutrition

Michelle Braun, PhD
Global Protein Scientific Affairs Lead
DuPont Nutrition & Biosciences

Michelle.Braun@dupont.com
dupontnutritionandhealth.com

Nutrition & Biosciences
<table>
<thead>
<tr>
<th>Protein Content (%)</th>
<th>Legumes</th>
<th>Cereal Grains</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Soy</td>
<td>Peanut</td>
<td>Pea</td>
</tr>
<tr>
<td>36</td>
<td>330</td>
<td>44</td>
<td>3</td>
</tr>
<tr>
<td>Dominant protein class</td>
<td>Globlulin</td>
<td>Globlulin</td>
<td>Globlulin</td>
</tr>
<tr>
<td>PDCAAS$^3$</td>
<td>0.96-1.00</td>
<td>0.52</td>
<td>0.70-0.89</td>
</tr>
<tr>
<td>Deficient Amino Acids$^4$</td>
<td>None</td>
<td>Lysine</td>
<td>Methionine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traditional Applications</th>
<th>Legumes</th>
<th>Cereal Grains</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Staple, tofu, oil</td>
<td>Staple, (bread)</td>
<td>Staple, malted for beer</td>
</tr>
<tr>
<td>Fortification Uses</td>
<td>Baked goods, meat &amp; vegetarian, nutrition bar, beverage</td>
<td>Baked goods, beverage, nutrition bar, meat, vegetarian</td>
<td>Baked goods, beverage, meat, vegetarian</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Usage barriers</th>
<th>Legumes</th>
<th>Cereal Grains</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allergen status</td>
<td>Flavor, supply</td>
<td>Flavor, protein content</td>
</tr>
</tbody>
</table>

$^1$2014-2015 data, except soy (2015-2016 data), $^2$Osborne classification, $^3$Protein Digestibility Corrected Amino Acid Score, $^4$By FAO standards, $^5$For children, not adults

* Food Sci Nutr. 2019;7:2932–2938

Nutrition & Biosciences
Soybean Processing

Soybean (~36% CP) → Soybean meal & flour/grits (44-48% & 50-53% CP) → Soy protein concentrate (65+% CP) → Soy protein isolate (85-90% CP)
Soy Protein Supply Chain

1. **Soybean seed producers**
2. **Farmers**
   - Plant and harvest soybeans
3. **Soybean storage**
4. **Soybean processing**
5. **Soy Flakes**
6. **Food & Beverages Manufacturers**
7. **DuPont Soy Protein**
8. **Soybean Oil**
9. **Soybean Meal**

**DuPont Soy Protein Supply Chain**
The source of it all: the bean

Typical Soybean Composition

- 40% Protein
- 15% Sugars & Oligosaccharides
- 20% Oil
- 15% Dietary Fiber
- 10% Other
- Storage proteins
- Whey proteins
- Isoflavones
- Saponins
- Sucrose, raffinose, stachyose
- Soluble & insoluble fiber
- Lecithin, sterols, vitamin E
- Moisture, ash

“Soy Protein Isolate” or “Isolated Soy Protein” is . . .

- Simply the protein portion of the soybean . . . protein from soy
- Nutritionally identical to the protein found in the native soybean . . . same amino acid composition
- A 90% protein content (dry basis) ingredient
- Among soy ingredients, the most flavor neutral and versatile
- Individual products designed to deliver functionality specific to end application
Soybean Processing

Cleaning  Cracking  Dehulling  Conditioning  Flaking

Soy grits/flour
Toasting

FULL FAT FLAKES

Cleanings  Hulls

Oil Extraction

CRUDE OIL

DEFATTED SOY FLAKES  

REFINED OIL  
LECITHIN

Soybean meal
Toasting
Fiber addition

Food Grade Defatted Flakes
Soy Protein Further Processing

- **Sizing**
  - Heating
  - **SOY GRITS**
  - Grinding
  - **SOY FLOUR**
  - Extrusion
  - **TEXTURED SOY FLOUR (TVP)**

- **FOOD GRADE DEFATTED FLAKES**
  - Extraction
  - **TRADITIONAL SOY PROTEIN CONCENTRATE**
  - Extrusion
  - **FUNCTIONAL SOY PROTEIN CONCENTRATE**
  - **TEXTURED SOY PROTEIN CONCENTRATE**

- **Extraction**
  - Complex Carbohydrates
    - **SOYO FIBER**
    - Precipitate
    - **ISOLATE**
    - Extrusion
    - **SOY PROTEIN NUGGETS**
    - **STRUCTURED SOY PROTEIN**
Plant Protein
Life Cycle Assessment

Life Cycle Assessments Consider Inputs from the Farm to Delivery to the Food Producer

1. First third party reviewed, ISO 14044 compliant LCA on isolated soy protein (ISP)

2. The LCA study includes soy cultivation, crushing, DuPont ISP production and transportation

3. The study focused on carbon footprint, water and land use footprints. 13 other environmental impact categories are quantified
Carbon Footprint of DuPont Soy Protein

DuPont ISP has the smallest carbon footprint

Kg CO₂e per kg protein

- 2.4 kg Isolated soy protein
- 16 kg Whey protein concentrate
- 17 kg Chicken
- 23 kg Skimmed milk powder
- 24 kg Pork
- 26 kg Caseinate
- 178 kg Beef (non-dairy)


Nutrition & Biosciences
DuPont ISP Water Footprint Is Among The Smallest

Liter blue water use per kg protein

- 36 liter  Whey protein concentrate
- 38 liter  Isolated soy protein
- 629 liter  Chicken
- > 1,600 liter  Pork (non-dairy)
- 629 liter  Beef (non-dairy)

DuPont ISP Has The Smallest Land Use Footprint

M² Year Per Kg Protein

- 8 m² y (Isolated soy protein)
- 19 m² y (Whey protein concentrate)
- 33 m² y (Chicken)
- 59 m² y (Pork)
- 1,311 m² y (Beef (non-dairy))

Sustainability Benefits of DuPont Isolated Soy Protein

Plant-based proteins, such as isolated soy protein, have a favorable environmental profile:

- Carbon footprint of DuPont ISP is 8 to 80 times lower than analyzed animal-based proteins.
- ISP requires less water and land than animal-based proteins to produce a kg of protein.
- Soybean cultivation is highly efficient, requiring limited use of water for irrigation.
- ISP is considered a high-quality protein, meeting the essential amino acid requirements of children and adults, and exhibiting unique health benefits.

Carbon Footprint
8 - 80 X

The Impact: What if Everyone in the US Substituted DuPont Soy Protein for Beef for One Day per Week?

This is roughly equivalent to taking 11 million cars off the streets.

1 day

When 1/7 of the total meat consumption is substituted with soy protein....

1 day

per week with soy protein instead

...this represents a savings of 50 million tons CO₂e every year, if applied in the U.S.
The Impact: What if DuPont Soy Protein and Whey Protein Shared Equally in the Global Sports Nutrition Market?

This is roughly equivalent to taking 90,000 cars off the streets.

50% soy protein
... this represents a savings of 424,000 tons CO₂e every year, if applied globally.

50% whey protein

Soy Protein

Powders:

- Isolates (90% Protein) or Concentrates (70% Protein)

Versatile range designed to deliver application-specific functionality for beverages – dry, RTD, spray-dried; extrusion; meat/poultry & meat-free; general protein fortification.

Soy Protein Extruded Crisps or Nuggets:

- 55-90% protein; adds crispy, crunchy texture to nutrition bars, cereals, snacks

Textured Soy Protein Concentrate:

- ~70% protein; flakes, granules, & crumbles. Ground meat & poultry, meat-free applications.

Structured Vegetable Protein:

- ~58-71% protein – whole-muscle like texture in shreds, chunks or strip formats. Meat & meat-free applications
Protein on the Nutrition Facts panel

Most basic way by which to communicate information about the protein content of your product

**Quantity**
Amount of protein by weight **is required**

**Quality**
Declaration of % DV for protein **is voluntary**

For % DV, required to adjust the actual amount of protein by multiplying it by the PDCAAS* value, to arrive at a “corrected amount of protein” which is then divided by the DRV for protein (50g)

A %DV is required to be listed
- if a claim is made for protein, such as "high in protein".
- food is meant for use by infants and children under 4 years old, none is needed.

Protein Digestibility-Corrected Amino Acid Score:  PDCAAS is a method of protein quality measurement based on the principle that the nutritive value of a protein depends on its ability to provide amino acids in adequate amounts to meet the requirements of children and adults. It is the method for protein quality measurement referenced in the current nutrition labeling guidelines.
Methods to assess Protein Quality have changed over time

FAO Committee on Protein Requirements first met in 1955. They periodically revise AA requirement patterns.

1991 FAO/WHO PDCAAS
- 2-5 yr old AA ref pattern
- Fecal Digestibility
- Truncation

PDCAAS is the globally recognized method for determining protein quality based on amino acid profile and digestibility.

2007 FAO/WHO AA Requirements
- New AA ref patterns including 1-2 & 3-10 yr old
- Fecal vs ileal digestibility
- Truncation vs no truncation

2007 FAO/WHO PDCAAS
- 3 AA ref patterns
- No truncation
- Ileal Digestibility
- Reactive lysine

2013 FAO DIAAS
- 3 AA ref patterns
- No truncation
- Ileal Digestibility
- Reactive lysine

2014 FAO Research Approaches
- 5 potential methods to address digestibility
- Need for further research

Protein quality assessment in follow-up formula for young children and ready to use therapeutic foods Report of the FAO Expert Working Group Rome, 6–9 November 2017

Historical PER
- No use of human AA reference pattern
- Rat growth model

FAO Committee on Protein Requirements first met in 1955. They periodically revise AA requirement patterns.
Soy protein is a high quality source of protein

... with a PDCAAS value of 1.0

<table>
<thead>
<tr>
<th>Protein</th>
<th>PDCAAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPRO® isolated soy protein</td>
<td>1.00</td>
</tr>
<tr>
<td>Milk (casein)</td>
<td>1.00</td>
</tr>
<tr>
<td>Egg white</td>
<td>1.00</td>
</tr>
<tr>
<td>Beef</td>
<td>0.92</td>
</tr>
<tr>
<td>Pea protein concentrate</td>
<td>0.73</td>
</tr>
<tr>
<td>Kidney beans</td>
<td>0.68</td>
</tr>
<tr>
<td>Pinto beans</td>
<td>0.63</td>
</tr>
<tr>
<td>Rolled oats</td>
<td>0.57</td>
</tr>
<tr>
<td>Rice</td>
<td>0.53</td>
</tr>
<tr>
<td>Peanut meal</td>
<td>0.52</td>
</tr>
<tr>
<td>Whole wheat</td>
<td>0.40</td>
</tr>
<tr>
<td>Wheat gluten</td>
<td>0.25</td>
</tr>
<tr>
<td>Almonds</td>
<td>0.23</td>
</tr>
</tbody>
</table>

As assessed using the globally recognized method, PDCAAS, soy protein is comparable to milk and eggs.

A score of 1.00 is the highest attainable score and is based on the amino acid reference pattern for 2.5 year olds. PDCAAS values from published sources or calculated using publicly available amino acid and digestibility values.

Adapted from Hughes et al., J Ag Food Chem. 2011

Soy protein meets the needs of children and adults

PDCAAS is the globally recognized method for assessing the ability of a protein to be well-digested and deliver amino acids in appropriate amounts to meet needs of children as well as adults.
Protein Quality put into practice

Prevalence of severe acute malnutrition (SAM)

Globally, about 20 million children suffer from severe acute malnutrition (SAM). While SAM is a cause of death in children in all parts of the world, it is most prevalent in Asia.


Wasting, or acute malnutrition, is the result of recent rapid weight loss or the failure to gain weight. Wasting refers to a child who is too thin for his or her height. A child who is moderately or severely wasted has an increased risk of death, but treatment is possible.

Study of isolated soy protein-based RUTF

This study tested Ready-to-Use Therapeutic Food (RUTF) made from isolated soy protein in comparison with the milk-based RUTF currently used for children suffering from severe acute malnutrition.

Children who receive proper treatment for recovery from malnutrition have the potential to grow up to lead normal and healthy lives.
Ready-to-Use Therapeutic Food (RUTF)
Based on isolated soy protein

Soy is a high-quality source of protein

Children with severe acute malnutrition who received the soy-based RUTF showed a similar pattern and rate of weight gain, changes in other anthropometric measures, and body composition as those who received the milk-based RUTF. High-quality soy protein supported similar recovery to the milk-based formula, due to the similar qualities of the two products.

Soy Protein supports many aspects of health across the lifespan

- Soy formulas are fortified with vitamins & minerals deliver the essential nutrition for growth & development.
- Milk formulated with soy protein great alternative for children who are lactose intolerant or allergic to dairy.
- Soy protein, as part of an exercise program, can help preserve lean muscle mass.
- Soy protein, as part of calorie controlled diet, can help weight management by helping you feel fuller, longer.
- A combo of soy protein, whey & casein, helps build & maintain muscle mass while providing all the essential amino acids & nutrients.
- 25 g/d of soy protein can decrease LDL-C levels, which may reduce risk for CVD.
**Soy, a high quality protein**

<table>
<thead>
<tr>
<th>Low in Fat</th>
<th>High Quality</th>
<th>Lactose-free</th>
<th>Good company</th>
<th>Supports Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy protein is low in fat and has no cholesterol.</td>
<td>Only widely available plant protein that provides all amino acids in appropriate amounts to meet needs of children and adults.</td>
<td>Soy has no lactose or, ‘milk-sugar’ that many people experience difficulty digesting.</td>
<td>Soy foods often also fortified with other key nutrients, including calcium, Vit D, and Vit B12.</td>
<td>100s of published studies demonstrate role of consuming soy protein for health, including heart health.</td>
</tr>
</tbody>
</table>
Polling Question

Is the sourcing of U.S. grown ingredients a priority for your company?

Yes  No
High Oleic Soybean Oil Functionality

SNACK ON THIS | PLANT BASED PROTEINS & SOY

Frank Flider, Oils Consultant
High Oleic Soybean Oil (HOSoy) Applications

PASTRIES
BISCUITS
CINNAMON ROLLS
TURNOVERS
COOKIES
CAKES
DONUTS
PIES
MARGARINE
VEGETABLE SHORTENING
ICINGS
SPREADS
DEEP FRYING
SAUTÉS
FRIED SNACKS
BAKED SNACKS
DRESSINGS
Benefits of HOSoy & Shortening

Enhanced Functionality  Neutral Flavor  Improved Fat Profile  Versatility

Improved Shelf Life  Sustainable  U.S. Grown  Increased Availability
## Fatty Acid Profile Comparison

<table>
<thead>
<tr>
<th>Source</th>
<th>0%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean</td>
<td>15</td>
<td>54</td>
</tr>
<tr>
<td>High Oleic Soybean</td>
<td>12</td>
<td>75</td>
</tr>
<tr>
<td>75% High Oleic Canola</td>
<td>7</td>
<td>74</td>
</tr>
<tr>
<td>65% High Oleic Canola</td>
<td>8</td>
<td>67</td>
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<tr>
<td>Nusun Sunflower</td>
<td>9</td>
<td>26</td>
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<tr>
<td>High Oleic Sunflower</td>
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<tr>
<td>Corn</td>
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<td>57</td>
</tr>
<tr>
<td>Sunflower</td>
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<tr>
<td>Canola</td>
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<tr>
<td>Palm</td>
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<tr>
<td>Cottonseed</td>
<td>27</td>
<td>19</td>
</tr>
<tr>
<td>Olive</td>
<td>15</td>
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</tr>
</tbody>
</table>

- **% Saturated Fatty Acid**
- **% Oleic Acid**
- **% Linoleic Acid**
- **% Linolenic Acid**
- **Trace Amounts**
- **% Other Acids**

HOSoy is the Best Solution for Replacing Synthetic Antioxidants

**OSI VALUE**

- Conventional Soy w/o antioxidants
- Conventional Canola oil w/o antioxidants
- HO Soy w/o antioxidants
- HO Canola oil w/o antioxidants
- Conventional Soy w/180ppm TBHQ
- Conventional Canola oil w/180ppm TBHQ
- HO Soy w/180ppm TBHQ
- HO Canola oil w/180ppm TBHQ

HOSoy offers highest OSI w/o antioxidants

Frying Evaluation
Study Design

Each variable, tested in duplicate:
- Commercial foodservice fryers
- Held at 350°F for eight hours per day
- 350g of fresh cut potatoes fried five minutes
- Four cycles per day
- 24 days total frying

Key metrics analyzed every three days for:
- Color
- Free Fatty Acid
- Total Polar Compounds
- Foaming
- Polymerization

Fry Study Results

High oleic soybean oil demonstrated a significantly increased fry-life over other commonly used frying oils.

High oleic soybean oil was neutral in flavor:
- Little or no contribution of flavor in and of itself.
- Allows the food item to impart its own flavor without competing flavors being introduced by the oil.

High oleic soybean oil left very little residue on the fryer making for an easier clean-up.

Longer Fry Life & Cost Savings

High Oleic Soybean Oil

Conventional Soybean Oil

HOSoy Blending Study
OSI of HOSoy Commodity Oil Blends

Oxidative Stability Index (OSI) of Commodity Oils Blended with High Oleic Soybean Oil

Blending with HOSoy Oil

More oleic content blended into a frying oil will:

• Extend Oxidative Stability Index (OSI) / shelf life of oil
• Extend deep frying oil life
• Decrease polymerization

Blending HOSoy with another high oleic oil (such as peanut oil) could extend supply without affecting deep frying oil performance.

• Additional work needed on sensory effects and flavor intensity

HOSoy is an excellent blending component due to its high stability and low flavor contributions.

HOSoy can minimize down time required in deep fryer cleaning due to minimal polymerization development.

Spray Oil Study
HOSoy Spray Oil Cracker Test

Oxidative stability of spray oil on crackers

• Straight dough, white pan bread (Ritz® style) crackers were produced with 11 different spray oil applications
• Spray oil was applied to 11% total cracker mass
• Crackers were sealed in clear plastic sleeves and stored in corrugated boxes at 70°F
• Crackers were sampled by a trained sensory panel monthly

Results

• Crackers turned stale before any of the oils showed signs of rancidity
• HO Soy displayed virtually no “weeping” on the wrapper or when removed from the wrapper and held on paper
• All other PHO replacements showed some degree of “weeping”
Baking Study
IE HOSoy as a PHO Replacement in Bakery
High Oleic Soybean Shortening

- “Drop In” replacement for PHO shortening
- Zero-trans formulation
- Similar oil binding characteristics to PHO
- Similar shortening texture to PHO
- Comparable working range to PHO
- Even more neutral flavor than PHO, far more neutral than palm oil

Sugar Cookies

Cookies made with high oleic soybean and conventional soybean shortening had a more tender mouthfeel.

White Cake

Cakes made with HOSoy shortening were most similar to cakes made with PHO shortening.

Most difference in dome-peak to edge ratio.

Buttercream Icing

Icing made with HOSoy shortening is smooth, light and easy to decorate with

Taste & Performance

“High oleic soybean oil has a neutral flavor and delivers very well as a frying medium.”

– Charlie Baggs

President and Executive Chef, Charlie Baggs Culinary Innovations
Performance

“I feel that high oleic soybean oil is the future! I look at high oleic soybean oil and say why isn’t everyone using it?”

– Emily Ellyn
Chef, Food Network Star
Polling Question

Thinking back to your perception of soy at the beginning of this webinar, how has your perception changed?

More positive  No change  More negative
Thank you!

Questions?

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