



Funds for this project were provided through the Idaho State Department of Agriculture Specialty Crop Block Grant Program.



webinar presentation



# USA Dry Pea & Lentil Council





# Presentation Objectives

- Overview: Pulses and pulse-based ingredients
- Dietary protein and consumers
- Proteins in nutrition and health
- Pulse proteins in food and beverage formulation
- Conclusions



## REMINDER

Please email Post-WEBINAR questions to [mfemreite@pea-lentil.com](mailto:mfemreite@pea-lentil.com)

## Section 1

# Overview: Pulse and Pulse-Based Ingredients

- Pulses – definitions and nomenclature
- Nutritional advantages of pulses
- Pulse production in the United States



### REMINDER

Please email WEBINAR questions [mfemreite@pea-lentil.com](mailto:mfemreite@pea-lentil.com)

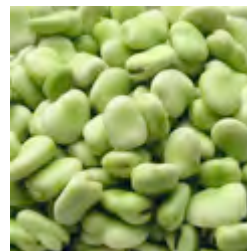
## What are Pulses?

1. Pulses are legumes classified separately from oilseeds, such as peanuts and soybeans.
2. There are **10 categories of pulses**, as defined by the U.N. Food & Agriculture Organization (FAO). Of these, seven are of commercial importance as foods and only five are significant in international food trade. The remainder serve primarily as animal feeds.
3. Because they return or “fix” nitrogen in the soil, pulses are **highly sustainable** and often used as rotational crops to restore the quality of farmland. They also require only minimal agricultural chemical treatments.
4. Rich in **protein, protein quality, soluble fiber, insoluble fiber, antioxidants, vitamins, minerals**, and **low in oil content**, pulses are gaining attention as nutritionally superior foods and food ingredients.
5. Pulses are used in many different ways in foods today.
6. Pulses are also **free of gluten and other allergens** that must be declared in FDA allergen declaration labels.

# What are Pulses?

## Pulses important to human food consumption:

1. Chickpeas (garbanzo beans)
2. Dry beans (*Phaseolus* spp.)
3. Lentils
4. Dry peas (field peas)
5. Broad (fava) beans
6. Pigeon peas
7. Cowpeas





# What are Pulses?

## Pulses that are important to food formulation

We will focus upon three categories produced in the United States:

- Chickpeas (garbanzo beans)
- Dry peas (field peas)
- Lentils

Chickpeas (Garbanzo)



Split Yellow Peas



Whole Green Peas



Regular Lentils



Pardina Lentils



Red Lentils



# Pulses offer Exceptional Nutritional Value

## PULSE COMPOSITION [ g/100g ]

Food Reference	Protein	Fat	Starch & Sugars	Fiber
Beef <sup>1</sup>	77.5	8.6	0.0	0.0
Whole Soy Flour - Raw	35.0	20.0	25.6	9.6
Dry Peas	23.7	1.3	45.5	16.6
Regular Lentils	26.3	1.1	45.0	13.6
Chickpeas	24.4	5.9	41.1	8.7
Whole Wheat	13.2	2.5	61.3	10.0
Whole Rice Flour	5.6	1.4	77.7	2.4
Tapioca Flour	0.2	0.0	87.8	0.9

## Plus...

- Superior amino acid profiles
- Vitamins
- Minerals
- Low-Glycemic Index
- Non-GMO

<sup>1</sup> Whole Chuck, 10% moisture basis

Sources: Canadian Grain Commission; U.S. Dept. of Agriculture-ARS; Cho, S., Prosky, L. and Dreher, M.  
Complex Carbohydrates in Foods, 1999, Marcel Dekker, Inc., New York, NY.



## Where are Pulses Grown?

The United States is one of the premier pulse-producing regions in the world.

U.S. Pulse Production		
	Metric Tons	Global Rank
	2011	
Dry Peas	255,150	9th
Lentils	214,640	5th
Chickpeas	97,205	16th

Source: United Nations FAOSTAT

### The United States also provides...

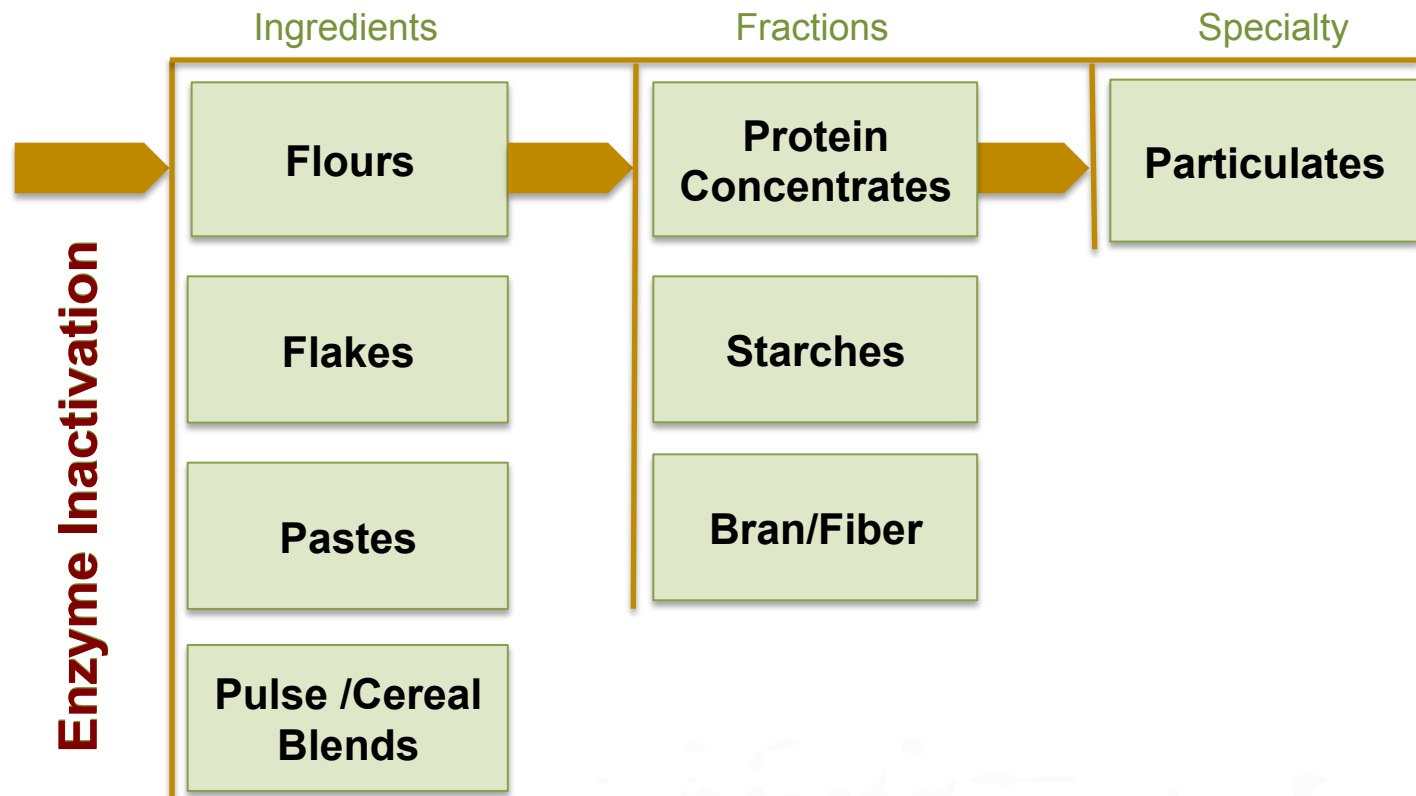
- A superior production, manufacturing and distribution infrastructure.
- Multiple university and technical centers to provide technical support and innovation.

Because of the U.S.'s highly developed quality grading, handling and production control systems, U.S. pulse producers receive top dollar for their pulses in world export markets.

# Pulses as Food Ingredients

Pulses can be processed into a variety of food ingredients.

- Dry peas
- Chickpeas
- Lentils



## Section 2

# Dietary Protein and Consumers

- How consumers view proteins in foods
- Pulses – no longer just center plate
- Pulse protein ingredients
- Pulse protein economics



### REMINDER

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# How consumers view proteins in foods

## Consumer Attitudes Toward Food Safety, Nutrition & Health

*Survey conducted by the International Food Information Council (IFIC)*

### *Study Demographics*

- ❑ 1,057 Americans, age 18 - 80
- ❑ Weighted by age, education, gender, race/ethnicity, and region.



# How consumers view proteins in foods

## 2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)

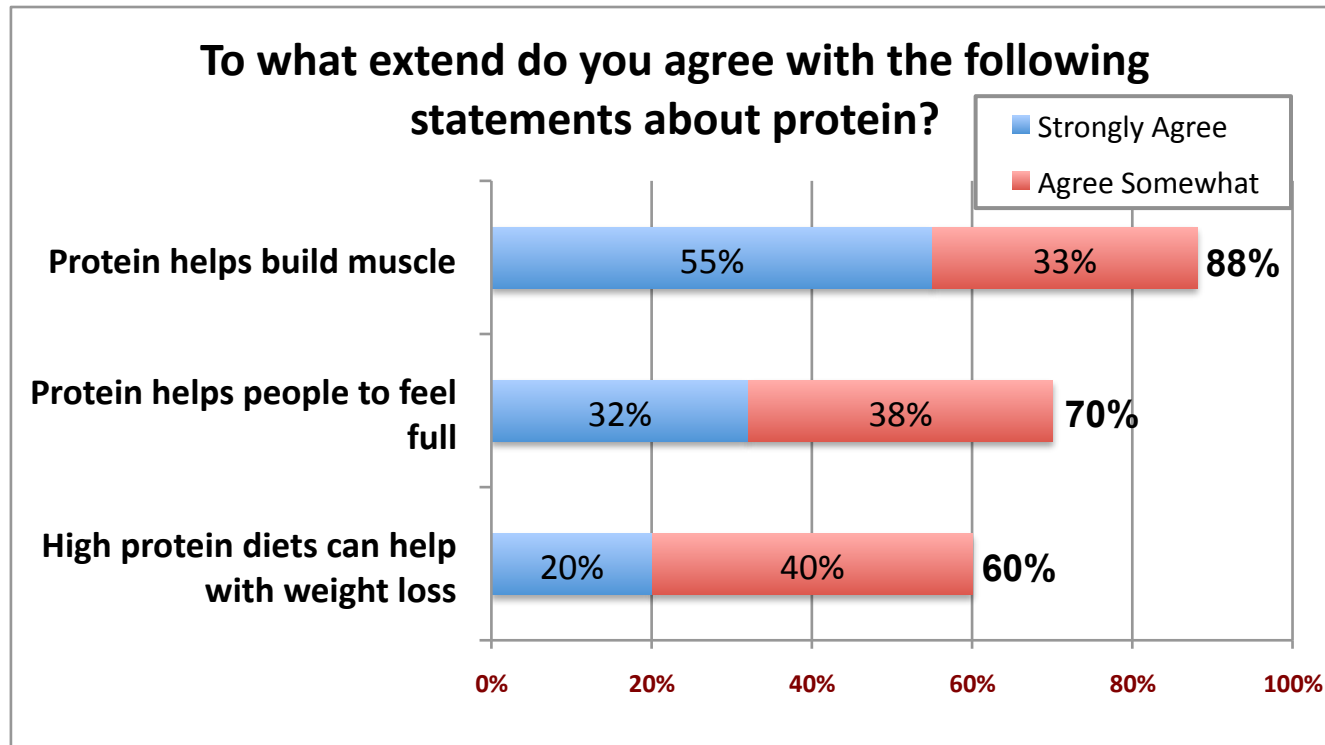
### *Top-Line Results*

- ❑ 48% of those surveyed try to consume products with more protein.
- ❑ 84% of those surveyed agree “strongly” or “somewhat” that it is easy to incorporate protein into their diets.

# How consumers view proteins in foods

## 2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)



# How consumers view proteins in foods

## 2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)

### What source of protein are you trying to consume?

<b>Poultry</b>	90%
<b>Nuts, seeds,...nut butters</b>	<b>87%</b>
<b>Eggs</b>	87%
<b>Fish</b>	80%
<b>Cheese and cottage cheese</b>	77%
<b>Beef</b>	76%
<b>Beans</b>	<b>74%</b>
<b>Milk</b>	70%
<b>Yogurt</b>	66%
<b>Cereals</b>	<b>62%</b>
<b>Protein Bars</b>	<b>35%</b>
<b>Soy</b>	29%
<b>Protein Shakes or Beverages</b>	<b>29%</b>
<b>Protein Supplement</b>	<b>15%</b>

# Pulse protein ingredients

Suppliers of pea, chickpea and lentil-based ingredients offer a wide range of highly specific protein and starch ingredients for use in food formulations.



## Available Pulse Ingredients

- Whole pulses
- Roasted pulses
- Flakes, grits
- Raw flours
- Air-classified flours
- Pre-cooked flours
- Pre-gelled flours
- Protein concentrates
- Protein isolates
- Starches
- Bran meal
- Fiber

## List of Pulse Ingredient Suppliers

**Best Cooking Pulses, Inc.**  
Portage La Prairie, MB

**Dakota Dry Bean, Inc.**  
Grand Forks, ND

**Fiberich Technologies, Inc.**  
St. Louis Park, MN

**George F. Brocke & Sons**  
Kendrick, ID

**Harvest Innovations**  
Indianola, IA

**Hinrichs Trading Co.**  
Pullman, WA

**Inland Empire Foods, Inc.**  
Riverside, CA

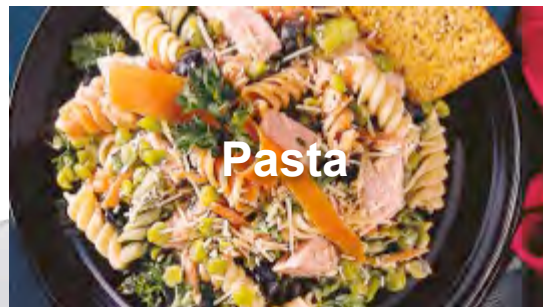
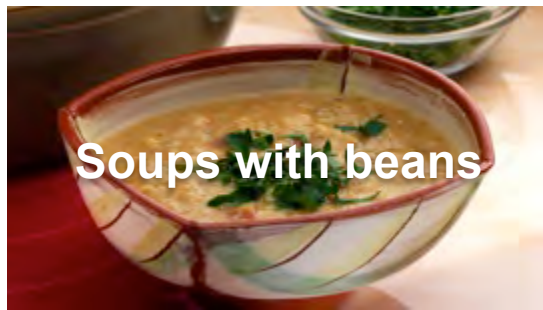
**SK Food International**  
Fargo, ND

**United Pulse Trading**  
Bismarck, ND

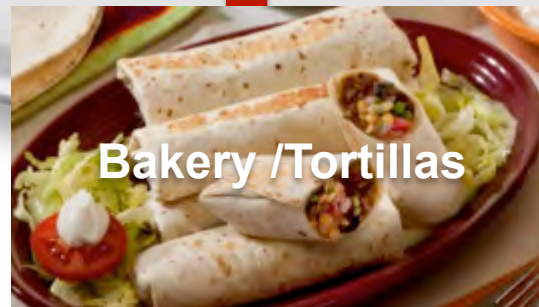
**Woodland Foods, Inc.**  
Gurnee, IL



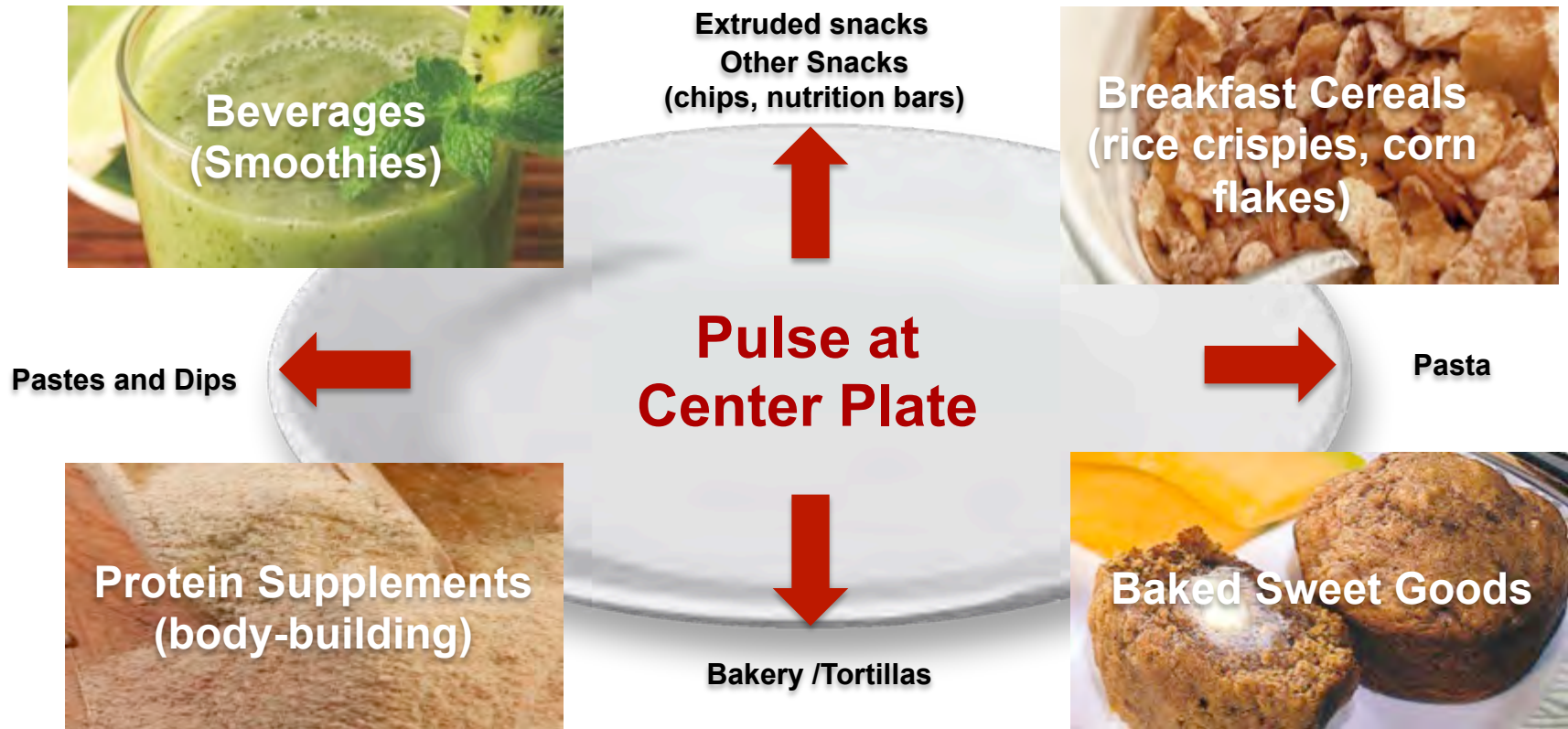
## Proteins at Center Plate



**Center Plate**



## Proteins out from Center Plate



Pulse protein ingredients enable the nutritional, functional and economic enhancement of new food and beverage categories.



## Where are pulse proteins being used?

But this ingredient category is still  
very early stage with a wide variety of  
consumer products.



Look out -  
new flavors coming soon!

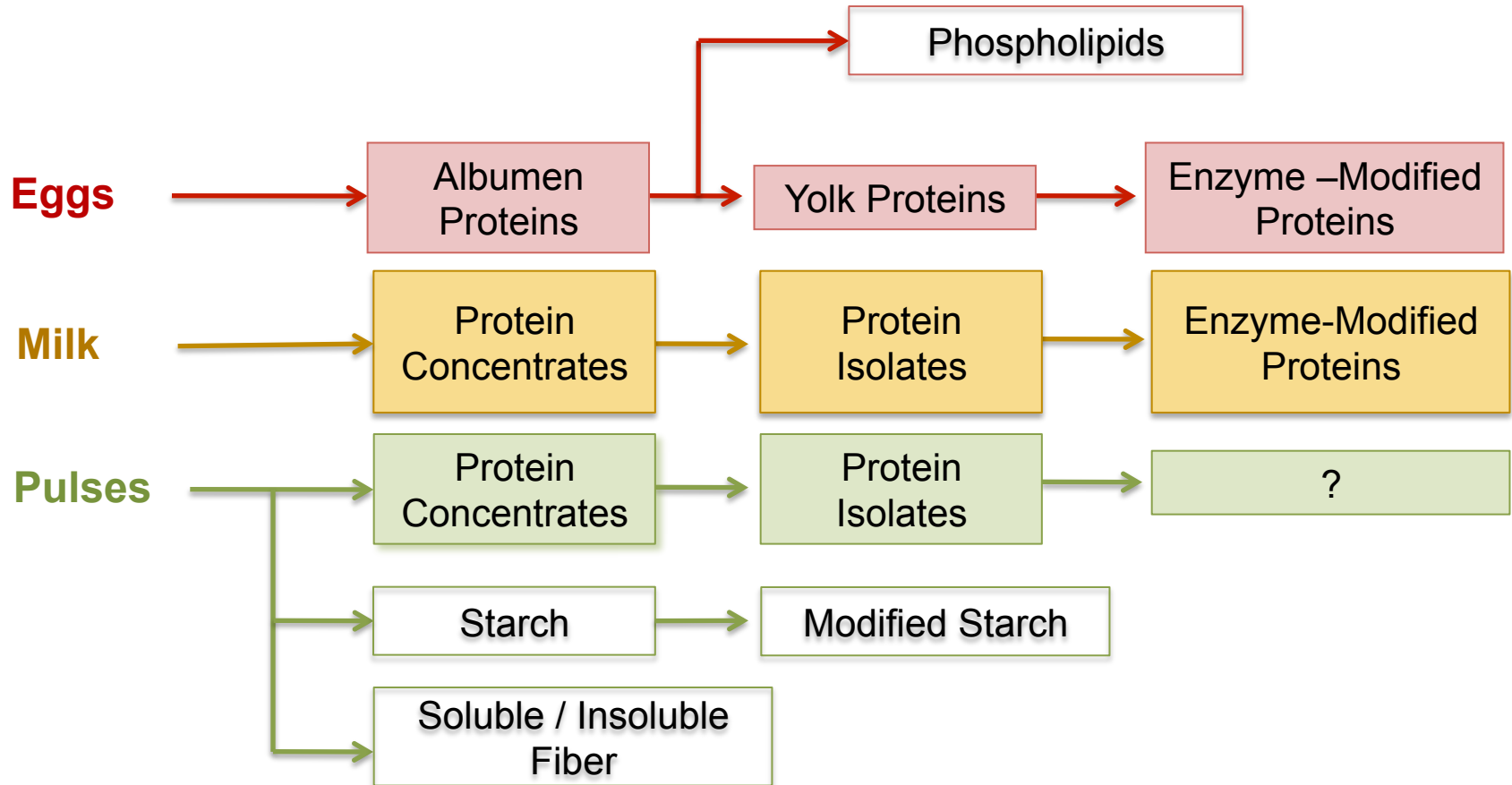


## **Pulse proteins are:**

- ☐ **Highly functional**
- ☐ **Cost-effective**
- ☐ **Cost-reliable**



## Common protein ingredients



# Functional Protein Ingredients

Raw Material Sources	<u>%-Protein</u>	Protein Concentrates	<u>%-Protein</u>	Protein Isolates
• Soy	35.0 %	• SPC (dry)	40-90%	SPI 90 + %
• Pulses	26.0 %	• PPC (dry)	40-90%	PPI 90 + %
• Milk (wet)	3.5 %	• MPC (dry)	40-90%	MPI 90 + %
• Whey (wet)	0.8 %	• WPC (dry)	40-90%	WPI 90 + %
• Eggs (wet)	10.9%	• Yolk (wet /dry)	15.8% protein	34.0% protein
		• Albumen (wet /dry)	8.0% protein	82.4% protein

# Functionality Benefits of Pulses

The functional properties of pulses replicate many of the functional properties of egg and dairy proteins.

## Egg and Dairy Protein Functionality

- Structure
- Strength
- Texture /mouthfeel
- Coloration
- Emulsification
- Gelation
- Film-forming
- Foaming
- Water control
- Viscosity
- Flavor
- Opacity / turbidity
- Particle suspension
- Adhesion
- Agglomeration

## Pulse Ingredient Functionality

- Structure
- Strength
- Texture /mouthfeel
- Emulsification
- Gelation
- Film-forming
- Foaming
- Water control
- Viscosity
- Opacity / turbidity
- Particle suspension
- Adhesion
- Agglomeration



# Pulse Ingredient Functionality

## Pea Protein



Aeration, foaming

Binding, adhesion

Emulsification

Humectancy

Crispness, strength

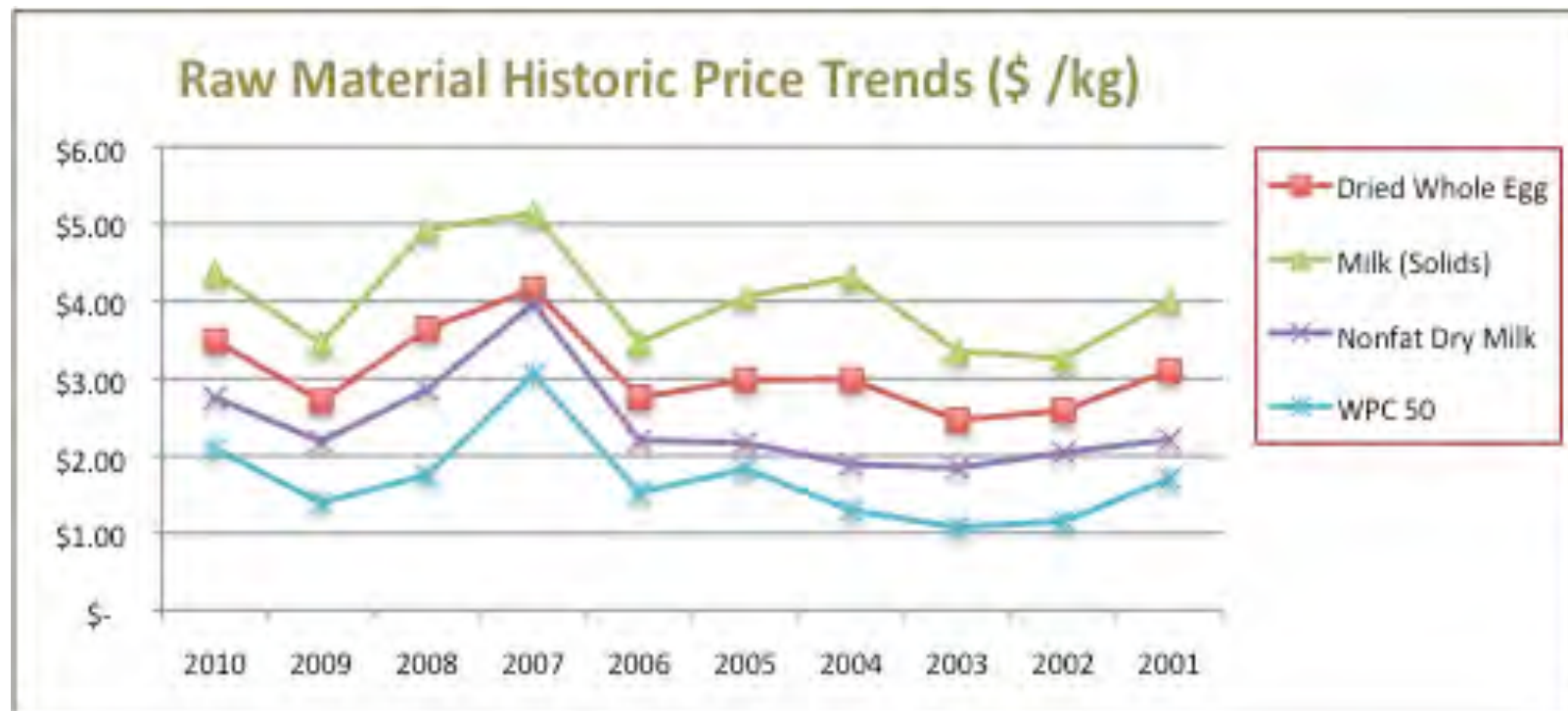
Thickening, mouthfeel





## Protein Ingredient Economics

Ten-year price trends for dried whole egg, dairy and pea ingredients.



# Protein Ingredient Cost Considerations

## Ingredient Price on Unit-Protein Basis (2010)

	%-Protein	\$/ kg -2010	\$/kg Protein
<b>Dried Whole Egg Powder</b>	47%	\$ 3.49	\$ 7.42
<b>Nonfat Dry Milk</b>	34%	\$ 2.75	\$ 8.09
<b>Whole Milk Solids</b>	27%	\$ 4.36	\$16.16
<b>WPC 50</b>	50%	\$ 2.09	\$ 4.18
<b>Peas (field)</b>	24%	\$ 0.19	\$ 0.80

Sources: FAOSTAT, University of Wisconsin Dept. of Agricultural Economic; USDA-ERS

# Protein Ingredient Cost Considerations

## Ingredient Price Volatility (2001–2010)

	%-Protein	Avg. Price ( \$/kg)	
<b>Dried Whole Egg Powder</b>	47%	\$ 3.09	
<b>Nonfat Dry Milk</b>	34%	\$ 2.41	
<b>Whole Milk Solids</b>	27%	\$ 4.04	
<b>WPC 50</b>	50%	\$ 1.69	
<b>Peas (field)</b>	24%	\$ 0.16	

Sources: FAOSTAT, University of Wisconsin Dept. of Agricultural Economic; USDA-ERS

## Section 3

# Proteins in Nutrition and Health

- Nutritional and nutraceutical values of pulse proteins
- Measures of protein value
- Protein requirements
- U.S. nutrient content claims
- Allergenicity



### REMINDER

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# Nutritional and Nutraceutical Value of Proteins

## Nutritional Benefits

- Nutrition
- Weight management
- Satiety

## Nutraceutical Benefits

- Tissue repair
- Cholesterol reduction
- Cancer prevention
- Psychological and behavioral

### Branch Chain A.A. by Protein Source:

	<b>Amino Acid as % of Total Protein</b>		
	<b>Pea</b>	<b>Lentil</b>	<b>Chickpea</b>
<b>Leucine</b>	7.5	7.9	7.3
<b>Isoleucine</b>	4.3	4.7	4.3
<b>Valine</b>	4.9	5.4	4.3
<b>Total:</b>	<b>16.7%</b>	<b>18.0%</b>	<b>15.9%</b>



# Measures of Protein Value

Pulses contain all the essential amino acids

Amino Acids	Split Peas	Lentil	Chickpea	Navy Bean	Pinto Bean	Soybean	Whole wheat	Brown Rice
Alanine	4.4	4.2	4.3	4.1	4.1	5.2	3.7	5.8
<b>Arginine</b>	8.9	7.7	9.4	5.4	5.1	8.6	4.9	7.6
Aspartic acid	11.8	11.1	11.8	13.0	10.6	14.0	5.5	9.4
<b>Cystine</b>	1.5	1.3	1.3	1.1	0.9	1.8	2.1	1.2
Glutamic acid	17.1	15.5	17.5	12.2	14.1	21.6	32.8	20.4
Glycine	4.4	4.1	4.2	3.4	3.7	5.2	4.3	4.9
<b>Histidine</b>	2.4	2.8	2.8	2.8	2.6	3.0	2.7	2.5
<b>Isoleucine</b>	4.1	4.3	4.3	4.4	4.1	5.4	3.4	4.2
<b>Leucine</b>	7.2	7.3	7.1	7.2	7.3	9.1	6.8	8.3
<b>Lysine</b>	7.2	7.0	6.7	5.7	6.3	7.4	2.7	3.8
<b>Methionine</b>	1.0	0.9	1.3	1.0	1.2	1.5	1.7	2.3
<b>Phenylalanin</b>	4.6	4.9	5.4	5.0	5.1	5.8	5.2	5.2
Proline	4.1	4.2	4.1	4.0	5.0	6.5	15.7	4.7
Serine	4.4	4.6	5.0	5.3	5.5	6.5	4.7	5.2
<b>Threonine</b>	3.6	3.6	3.7	4.2	3.8	4.8	2.8	3.7
<b>Tryptophan</b>	1.1	0.9	1.0	1.0	1.1	1.6	1.3	1.3
<b>Tyrosine</b>	2.9	2.7	2.5	3.4	2.0	4.2	2.1	3.8
<b>Valine</b>	4.7	5.0	4.2	5.1	4.7	5.6	4.3	5.9

\* Amino Acids highlighted in "yellow" are essential for infants only.

# Measures of Protein Value

Peas, chickpeas and lentils have similar amino acid profiles

Amino Acids	Split Peas	Lentil	Chickpea	Navy Bean	Pinto Bean	Soybean	Whole wheat	Brown Rice
Alanine	4.4	4.2	4.3	4.1	4.1	5.2	3.7	5.8
Arginine	8.9	7.7	9.4	5.4	5.1	8.6	4.9	7.6
Aspartic acid	11.8	11.1	11.8	13.0	10.6	14.0	5.5	9.4
Cystine	1.5	1.3	1.3	1.1	0.9	1.8	2.1	1.2
Glutamic acid	17.1	15.5	17.5	12.2	14.1	21.6	32.8	20.4
Glycine	4.4	4.1	4.2	3.4	3.7	5.2	4.3	4.9
Histidine	2.4	2.8	2.8	2.8	2.6	3.0	2.7	2.5
Isoleucine	4.1	4.3	4.3	4.4	4.1	5.4	3.4	4.2
Leucine	7.2	7.3	7.1	7.2	7.3	9.1	6.8	8.3
Lysine	7.2	7.0	6.7	5.7	6.3	7.4	2.7	3.8
Methionine	1.0	0.9	1.3	1.0	1.2	1.5	1.7	2.3
Phenylalanine	4.6	4.9	5.4	5.0	5.1	5.8	5.2	5.2
Proline	4.1	4.2	4.1	4.0	5.0	6.5	15.7	4.7
Serine	4.4	4.6	5.0	5.3	5.5	6.5	4.7	5.2
Threonine	3.6	3.6	3.7	4.2	3.8	4.8	2.8	3.7
Tryptophan	1.1	0.9	1.0	1.0	1.1	1.6	1.3	1.3
Tyrosine	2.9	2.7	2.5	3.4	2.0	4.2	2.1	3.8
Valine	4.7	5.0	4.2	5.1	4.7	5.6	4.3	5.9

# Measures of Protein Value

The high-lysine content of pulses complements the low lysine of cereals

Amino Acids	Split Peas	Lentil	Chickpea	Navy Bean	Pinto Bean	Soybean	Whole wheat	Brown Rice
Alanine	4.4	4.2	4.3	4.1	4.1	5.2	3.7	5.8
Arginine	8.9	7.7	9.4	5.4	5.1	8.6	4.9	7.6
Aspartic acid	11.8	11.1	11.8	13.0	10.6	14.0	5.5	9.4
Cystine	1.5	1.3	1.3	1.1	0.9	1.8	2.1	1.2
Glutamic acid	17.1	15.5	17.5	12.2	14.1	21.6	32.8	20.4
Glycine	4.4	4.1	4.2	3.4	3.7	5.2	4.3	4.9
Histidine	2.4	2.8	2.8	2.8	2.6	3.0	2.7	2.5
Isoleucine	4.1	4.3	4.3	4.4	4.1	5.4	3.4	4.2
Leucine	7.2	7.3	7.1	7.2	7.3	9.1	6.8	8.3
<b>Lysine</b>	<b>7.2</b>	<b>7.0</b>	<b>6.7</b>	5.7	6.3	7.4	<b>2.7</b>	<b>3.8</b>
Methionine	1.0	0.9	1.3	1.0	1.2	1.5	1.7	2.3
Phenylalanine	4.6	4.9	5.4	5.0	5.1	5.8	5.2	5.2
Proline	4.1	4.2	4.1	4.0	5.0	6.5	15.7	4.7
Serine	4.4	4.6	5.0	5.3	5.5	6.5	4.7	5.2
Threonine	3.6	3.6	3.7	4.2	3.8	4.8	2.8	3.7
Tryptophan	1.1	0.9	1.0	1.0	1.1	1.6	1.3	1.3
Tyrosine	2.9	2.7	2.5	3.4	2.0	4.2	2.1	3.8
Valine	4.7	5.0	4.2	5.1	4.7	5.6	4.3	5.9

# Measures of Protein Value

## Protein Digestibility Score

“A measure of the efficiency of the protein in a foodstuff for the maintenance and growth of the bodily tissues of an individual, computed as the percentage of protein intake actually utilized in the body”

– Merriam Webster

Dry peas = 72

Corn = 40

Gelatin = 0

Source: N. Jeradechachai, Northern Crops Institute

# Measures of Protein Value

## Protein Digestibility Corrected Amino Acid Score “PDCAAS”

A measurement of protein quality found by multiplying the

	<b>Pea* Protein</b>	<b>FAO Req. Children(2-5)</b>	<b>FAO Req. Adults</b>
Cysteine + Methionine	<b>2.1</b>	<2.5	>1.7
Histidine	<b>2.5</b>	>1.9	>1.6
Isoleucine	<b>4.5</b>	>2.8	>1.3
Leucine	<b>8.4</b>	>6.6	>1.9
Lysine	<b>7.2</b>	>5.8	>1.6
Phenylalanine + Tyrosine	<b>9.3</b>	>6.3	>1.9
Threonine	<b>3.9</b>	>3.4	>0.9
Tryptophan	<b>1.0</b>	>1.1	>0.5
Valine	<b>5.0</b>	>3.5	>1.3

Source: Calculations based on Roquette Nutralys® Protein



# Measures of Protein Value

## Protein Digestibility Corrected Amino Acid Score “PDCAAS”

### Comparative PDCAAS Values for Pea Protein

<b>Eggs</b>	<b>1.00</b>
Pea Protein (75%) + Wheat Gluten (25%)	0.87
Pea Protein Isolate	0.82
Pea (yellow, split)	0.64
Wheat Flour	0.43

Sources: Pulse Canada; Roquette

# How much protein do people need?

	Recommended Dietary Allowance (RDA)	Daily Reference Value (DRV)
Infants:	10g /day	50g /day
Teenage Males	52g /day	
Teenage Females	46g /day	
Adult Males	56g /day	
Adult Females	46g /day	
Pregnant or Lactating Females	71g /day	

- 7.7% of females consume less-than minimum requirement
- 8.0% of older adult women consume less-than minimum requirement
- Median intake of children is 13.4% below minimum.

Source: National Health and Nutrition Examination Survey

# What about protein content claims?

## U.S. Nutrient Content Claims (21CFR 101.54)

A food or beverage product may claim the following:

- “Added Protein”
- “Extra Protein”
- “Fortified with Protein”
- “Enriched in Protein”
- “More Protein”

...if it contains more-than 10% of the protein DRV value than the reference serving size of that food (RACC) normally contains.

A food or beverage product may claim the following:

- “Good Source of Protein”
- “Contains Protein”
- “Provides Protein”

...if it contains more-than 10% of the DRV for protein (> 5g) per reference serving size (RACC).

A food or beverage product may claim the following:

- “Excellent Source” of Protein”
- “Rich Source of Protein”
- “High Source of Protein”

...if it contains more-than 20% of the DRV for protein (> 10g) per reference serving size (RACC).

“Reference amounts customarily consumed per eating occasion” (RACCs) for food and beverage products can be found in 21CFR101.12 of the Code of Federal Regulations.

# Gluten and Other Allergen Concerns

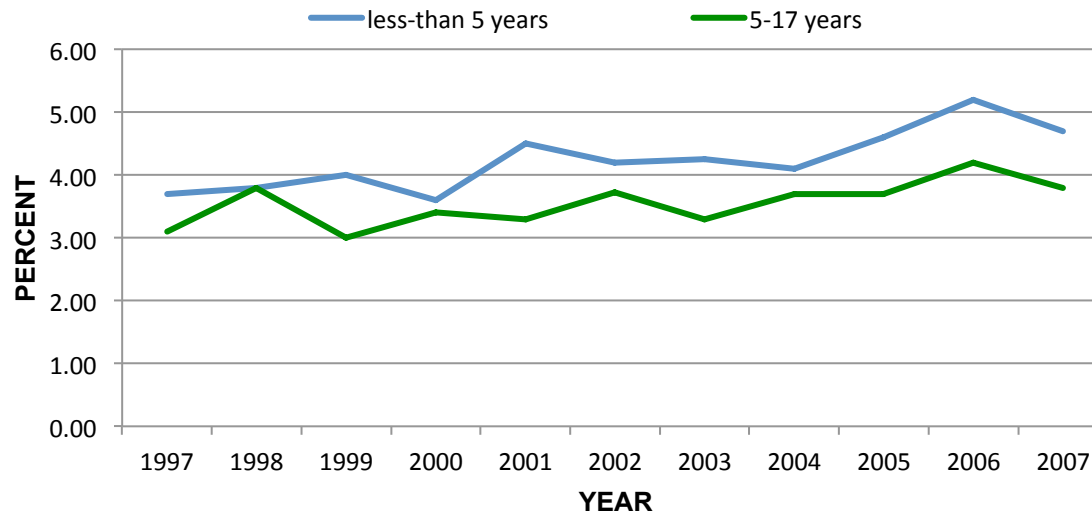
## U.S. Food Allergen Labeling and Consumer Protection Act of 2004

FALCPA passage was based on estimates that eight major food allergens account for 90% of all food allergies:

- Milk
  - Eggs
  - Fish
  - Crustacean shellfish
  - Tree nuts
  - Peanuts
  - Wheat
  - Soybeans
- FALCPA required all foods to clearly identify all ingredients that contained one or more of the identified allergens.
  - Pulses can play important roles as ingredient alternatives for those food allergens highlighted in **red**.

# Why Food Allergens are of Concern?

Percent of children with a reported food or digestive allergy in 12-month period



*The incidence of food allergies in children has been trending upwards.*



# How Big is the Allergen Averse Market Opportunity?

When we include the following categories that are not included in the often-quoted **Packaged Facts** or **SPINS /Mintel** gluten-free market surveys:

- Walmart (about 15% of all retail food and foodservice sales)
- Trade Joe's
- Restaurant /food service
- Store brands
- PLU (coded-entry sales)
- Multilevel marketers
- Internet Sales



(Oct., 2012) **Packaged Facts** - \$4.2b in 2012

(Sept., 2011) **SPINS /Mintel** – \$6.0b ....  
**\$12.4b in 2012** (revised to incl. Walmart)

**BEST VANTAGE Inc.** estimates the current gluten- and allergen-free market size at \$10 - 15 billion with a potential to reach **\$70** billion by 2020.

## Section 4

# Pulse Proteins in Food and Beverage Formulation

- Bakery goods: cakes
- Bakery goods: cookies
- Battered and fried products
- Pasta
- Beverages & Smoothies



**REMINDER** Please email Post-WEBINAR questions to [mfemreitel@pea-lentil.com](mailto:mfemreitel@pea-lentil.com)

# How to use pulses as egg and dairy alternatives and extenders

## Resources:



### Northern Crops Institute

NDSU Dept. 7400  
PO Box 6050  
Fargo, North Dakota, USA 58108-6050  
Phone: 701-231-7736  
Fax: 701-231-7235  
Email: [nci@ndsu.edu](mailto:nci@ndsu.edu)



**Prof. Cliff Hall III**



**Thunyaporn ("Naggie")  
Jeradechachai**

# Pulse Flour Properties

## Pea Flour



Aeration, foaming

Binding, adhesion

Emulsification

Humectancy

Crispiness, strength

Thickening, mouthfeel





# Pulse Protein Properties

## Pea Protein

Aeration, foaming

Binding, adhesion

Emulsification

Humectancy

Crispiness, strength

Thickening, mouthfeel





# Sweet bakery goods

## Pulse proteins can substitute for egg and dairy proteins

### Cakes and Cookies



- Aeration, foaming
- Binding, adhesion
- Emulsification
- Gelation, coagulation

- Pulse flour
- Cooked pulse flour
- Pregel pulse flour
- PPC
- PPI
- Pulse starch
- Pulse bran

Degree of Egg or Dairy Substitution: **100%**

# Sweet bakery goods

## Layer cakes

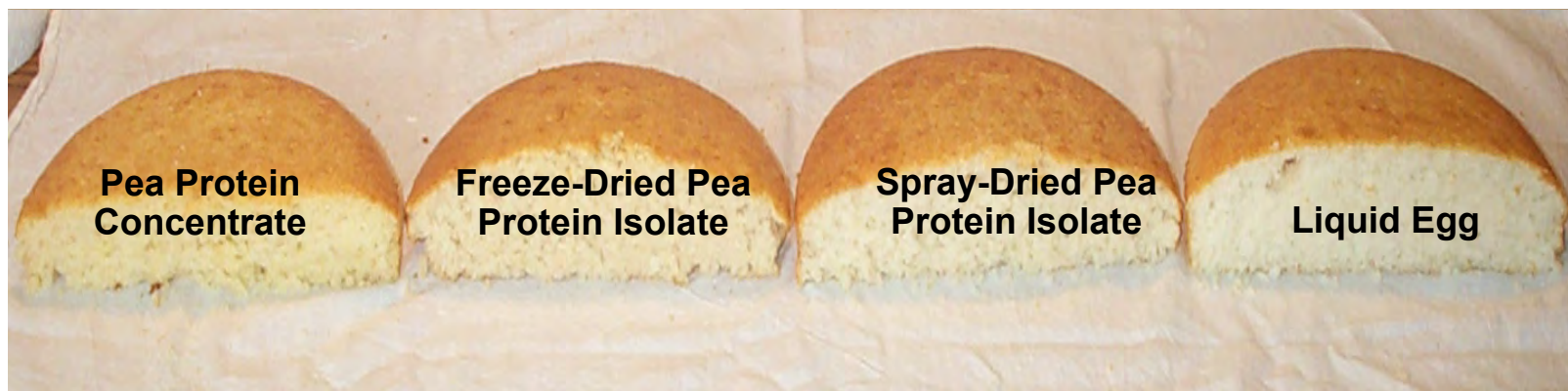
### White Cake Formula weight (g)

	w/Egg	w/ PPI
Cake flour	130	130
Baking powder	7	7
Shortening	50	50
Pea Protein	-	6
Water	45	115
Fresh Whole Egg	69	-
Sugar	100	100
Salt	3	3
Vanilla Powder	3	3
	<b>407</b>	<b>414</b>

Source: "Sensory Qualities of Cakes and Cookies Made with Pea Proteins as an Egg Replacer.", 2012: Mary Niehaus, Clifford Hall III and Hieu Hoang; School of Food Systems, North Dakota State University, Fargo, ND

# Sweet bakery goods

## Layer cakes



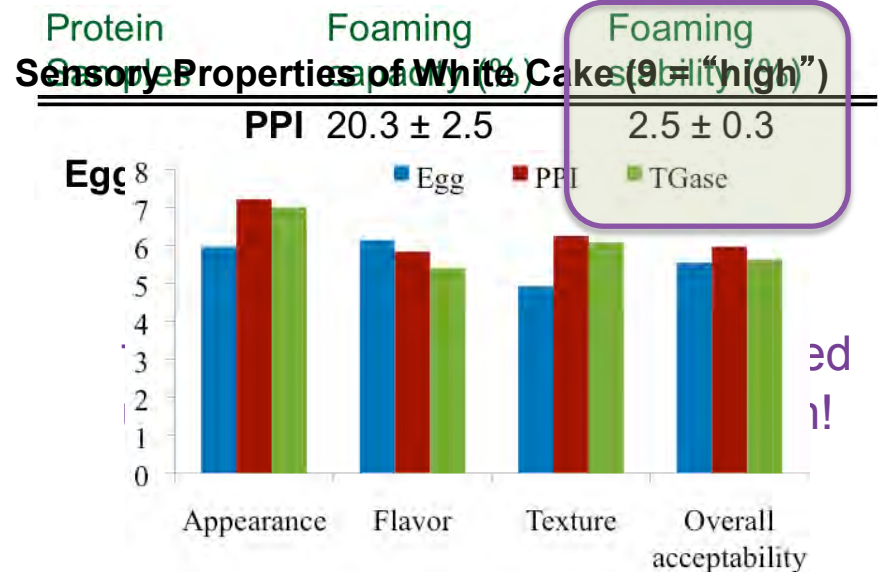
White cakes prepared from pea concentrate, peas isolates, and eggs. Surface and cross-sectional views are presented of the cakes.

*Research conducted by Dr. Clifford Hall III, Associate Professor, Food and Cereal Science, North Dakota State University*

# Sweet bakery goods

## Layer cakes

	White Cake Formula weight (g)	
	w/Egg	w/ PPI
Cake flour	130	130
Baking powder	7	7
Shortening	50	50
Pea Protein	-	6
Water	45	115
Fresh Whole Egg	69	-
Sugar	100	100
Salt	3	3
Vanilla Powder	3	3
	<b>407</b>	<b>414</b>



Source: "Sensory Qualities of Cakes and Cookies Made with Pea Proteins as an Egg Replacer.", 2012: Mary Niehaus, Clifford Hall III and Hieu Hoang; School of Food Systems, North Dakota State University, Fargo, ND



# Impact on Nutritional Labels

## Gluten-Free Shortbread

**INGREDIENTS:** Gluten-Free Flour (tapioca flour, rice flour), Sugar, Butter, Eggs, Salt, Baking Soda, Flavor, Xanthan Gum

**Replacement of 30% of a gluten-free blend of tapioca and rice flours with lentil flour resulted in:**

- Increased **protein** from 1g to 2g per 30g serving.
- Increased **Total Dietary Fiber** from 0g to 2g per 30g serving.

Nutrition Facts			
Serving Size (30g)			
Servings Per Container			
Amount Per Serving			
<b>Calories</b>	120	<b>Calories from Fat</b>	45
		% Daily Value*	
<b>Total Fat</b>	5g		8%
Saturated Fat	3g		15%
Trans Fat	0g		
<b>Cholesterol</b>	25mg		8%
<b>Sodium</b>	55mg		2%
<b>Total Carbohydrate</b>	19g		6%
Dietary Fiber	0g		0%
Sugars	6g		
<b>Protein</b>	1g		
Vitamin A 4% • Vitamin C 0%			
Calcium 0% • Iron 0%			
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:			
	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g
Calories per gram:			
Fat 9 • Carbohydrate 4 • Protein 4			

Nutrition Facts			
Serving Size (30g)			
Servings Per Container			
Amount Per Serving			
<b>Calories</b>	120	<b>Calories from Fat</b>	45
		% Daily Value*	
<b>Total Fat</b>	5g		8%
Saturated Fat	3g		15%
Trans Fat	0g		
<b>Cholesterol</b>	25mg		8%
<b>Sodium</b>	55mg		2%
<b>Total Carbohydrate</b>	18g		6%
Dietary Fiber	2g		8%
Sugars	6g		
<b>Protein</b>	2g		
Vitamin A 4% • Vitamin C 0%			
Calcium 0% • Iron 4%			
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:			
	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g
Calories per gram:			
Fat 9 • Carbohydrate 4 • Protein 4			



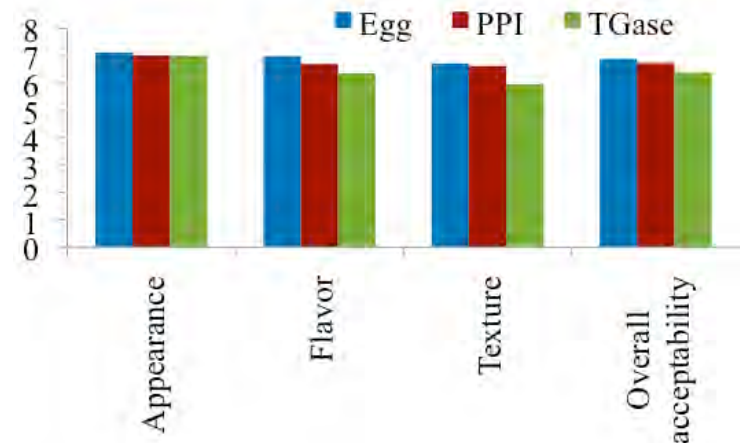
# Sweet bakery goods

## Sugar Snap Cookies

**Sugar Cookie Formula**  
**Formula weight (g)**

	w/Egg	w/ PPI
Cake flour	175.0	175.0
Butter	113.0	113.0
Sugar	75.0	75.0
Brown Sugar	56.0	56.0
Fresh Egg	23.0	-
Pea Protein -		3.0
Water -		22.0
Salt	1.5	1.5
Baking Soda	2.7	2.7
	<b>446.2</b>	<b>448.2</b>

**Sensory Properties of Sugar Cookies (9 = “high”)**



Source: “Sensory Qualities of Cakes and Cookies Made with Pea Proteins as an Egg Replacer.”, 2012: Mary Niehaus, Clifford Hall III and Hieu Hoang; School of Food Systems, North Dakota State University, Fargo, ND

## Pasta (Gluten-Free)

### Base Formula

100% - pulse flour  
32–35% - water



Blend dry ingredients



Add water (40°C / 104°F)  
to the blend



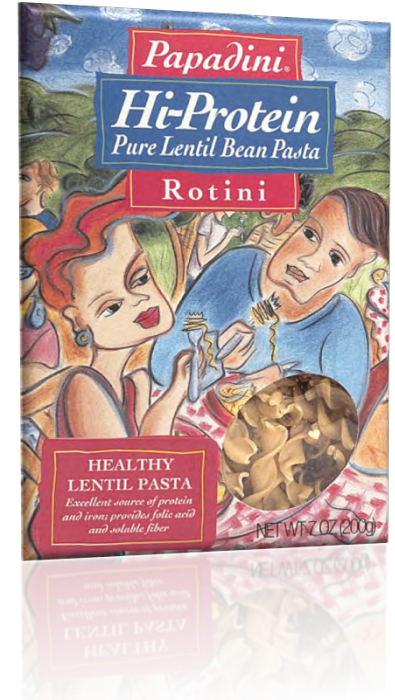
Cut



Extrude



Mix



# Pasta

## Level of pea flour incorporation

	0%	5%	10%	15%	20%
<b>Cooking Quality (al dente)</b>					
Cooked Wt (g)	75.8	75.3	77.7	77.2	76.3
Cooking Loss (%)	5.9	5.6	5.9	6.1	6.3
Cooked Firmness (g cm)	12.9	12.4	12.5	13.4	14.4
<b>Cooking Quality (overcook 6 min)</b>					
Cooked Wt (g)	87.4	86.7	87.9	88.0	88.0
Cooking Loss (%)	7.2	6.6	7.3	7.2	7.3
Cooked Firmness (g cm)	9.3	9.0	9.1	9.6	10.2

The al dente cooking quality of the pasta is increased with the addition of pea flour incorporation.

Source: Northern Crops institute

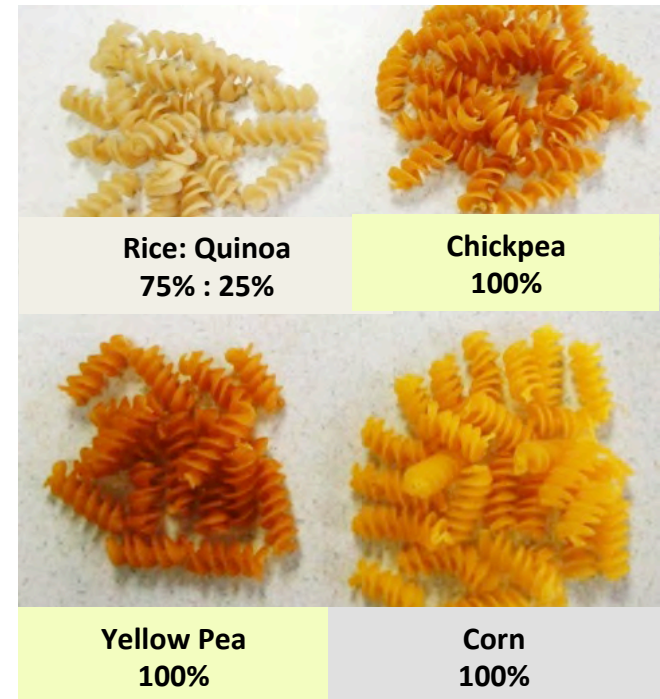


**Useful tip:** Addition of 0.5-1.0% calcium sulfate will further increase al dente texture and robustness.

*\* Patent Pending*



# Pasta



## 100% Legume Pasta

**Useful tip:** Addition of 0.5-1.0% calcium sulfate will further increase al dente texture and robustness.

*\* Patent Pending*

# Pasta

## Gluten-Free Organic Lentil Pasta

RACC serving size (dry) : 55g      %-Formula

- 13.5g Protein per serving      **24.7%**
- 8.4g Total Dietary Fiber per serving      **15.3%**

### Percent Daily Value

- Riboflavin      15%
- Calcium      20%
- Vitamin B6      10%
- Iron      40%
- Thiamin      20%
- Niacin      8%
- Folate      30%
- Zinc      25%

**An Excellent  
Source of Protein**

**An Excellent  
Source of Fiber**

<b>Nutrition Facts</b>	
Serving Size 3 oz (85g)	
Servings Per Container 4	
Amount Per Serving	
<b>Calories</b> 310	Calories from Fat 10
% Daily Value*	
<b>Total Fat</b> 1g	<b>1%</b>
Saturated Fat 0g	<b>0%</b>
Trans Fat 0g	
<b>Cholesterol</b> 0mg	<b>0%</b>
<b>Sodium</b> 10mg	<b>0%</b>
<b>Total Carbohydrate</b> 56g	<b>19%</b>
Dietary Fiber 13g	<b>54%</b>
Sugar 6g	
<b>Protein</b> 21g	
Vitamin A 0%	• Vitamin C 2%
Calcium 20%	• Iron 40%
Vitamin D 0%	• Thiamine 20%
Riboflavin 15%	• Niacin 8%
Vitamin B <sub>6</sub> 10%	• Folate 30%
Vitamin B <sub>12</sub> 0%	• Zinc 25%



# Battered, breaded and fried products

## Pulse-based “egg” wash and binder



- Binding, adhesion
- Emulsification
- Oil barrier
- Gelation, coagulation

- Pulse flour
- Cooked pulse flour
- Pregel pulse flour
- PPC
- Pulse starch
- Pulse bran

Degree of Egg or Dairy Substitution: **100%**

# Battered, breaded and fried products

## Pulse-based “egg” wash and binder



### Eggless Tempura Batter

Ingredients	grams	Formula %-percent
All-purpose flour	125.0	29.1%
Sugar	11.0	2.6%
Seasoned Salt Mix	8.0	1.9%
Water	265.0	61.7%
<b>Pregelld Yellow Pea Flour</b>	<b>10.0</b>	<b>2.3%</b>
Guar Gum	7.5	1.7%
Xanthan Gum	2.5	0.6%
Lecithin	0.5	0.1%
	429.5	100.0%

Source: Harvest Innovations

### Instructions:

#### Pre-Dust

1. Mix: 20g **Pregelld Yellow-Pea Flour**  
250g All-Purpose Flour
2. Pre-dust meat or vegetable in mixture

#### Eggless Coating Batter

1. Blend dry ingredients
2. Add water and blend until smooth
3. Dip meat or vegetable into coating batter

#### Coating

1. Roll battered meat or vegetable in Tempura crumbs
2. Add to oil and fry until done at 350°F / 178°C

Degree of Egg or Dairy Substitution: **100%**

# Beverages and Smoothies

## The Basics...

1. Pea, chickpea and lentil proteins have similar iso-electric points ( $\text{pH} = 4.6$ ), at which point the proteins precipitate (i.e., the  $\text{pH}$  of minimum solubility).
2. The solubility characteristics of proteins will depend upon how the proteins were processed.
3. Pulse protein solubility is about 20% at  $\text{pH} < 3.0$  or  $\text{pH} > 5.5$ .
4. Pulse protein solubility is about 50% at  $\text{pH} < 2.5$  or  $\text{pH} > 6.5$ .
5. Use organic acids to adjust (buffer)  $\text{pH}$ s.



### Typical Acidities

	<u>pH</u>
Milk	6.4 - 6.8
Sweet whey	5.6 - 6.5
Coffee	5.0 - 7.0
Vinegar	4.0 - 5.0
Yogurt	4.6 - 4.8
Root beer	4.0 - 4.2
Apple juice	3.4 - 4.0
Orange juice	2.6 - 3.0
Coca Cola	2.0 - 2.2

# Beverages and Smoothies

## Cinnamon-Vanilla Protein Beverage

	Formula Weight (g)
<b>Water</b>	867.8
<b>Pea Protein Isolate</b>	70.0
<b>Sugar</b>	60.0
<b>Vanilla Powder</b>	1.0
<b>Gellan Gum</b>	1.0
<b>Cinnamon</b>	0.2
	<b>1000.0</b>

1. Blend dry ingredients.
2. Add to hot water (203°F / 95°C) in blender while mixing (low speed).
3. Mix, high speed, for 3-minutes.

Nutrition Facts	
Serving Size 296 g	
Amount Per Serving	
Calories 160	Calories from Fat 10
% Daily Value*	
Total Fat 1g	2%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 40mg	2%
Total Carbohydrate 22g	7%
Dietary Fiber 0g	0%
Sugars 20g	
Protein 16g	

**An excellent  
source of protein**

**16 grams Protein  
per Serving**



Source: Harvest Innovations

# Beverages and Smoothies

## Chocolate-Flavored Protein Beverage

	Formula Weight (g)
<b>Water</b>	846.2
<b>Pea Protein Isolate</b>	69.0
<b>Sugar</b>	67.7
<b>Cocoa Powder</b>	14.8
<b>Gellan Gum</b>	1.2
<b>Vanilla Flavor</b>	0.6
<b>Salt</b>	0.5
	1000.0

1. Blend dry ingredients.
2. Add to hot water (203°F / 95°C) in blender while mixing (low speed).
3. Mix, high speed, for 3-minutes.
4. Homogenize (2x @ 10,000 psi).
5. Fill into containers and seal.
6. Keep refrigerated.

Nutrition Facts	
Serving Size 296 g	
Amount Per Serving	
Calories 170	Calories from Fat 15
% Daily Value*	
Total Fat 2g	3 %
Saturated Fat 0.5g	3 %
Trans Fat 0g	
Cholesterol 0mg	0 %
Sodium 100mg	4 %
Total Carbohydrate 24g	8 %
Dietary Fiber 2g	8 %
Sugars 20g	
Protein 17g	

**An excellent  
source of protein**



**17 grams Protein  
per Serving**

Source: Harvest Innovations



## Section 4

# Summary and Conclusions

- Summary & Conclusions
- Resources
- Questions and Answers



### REMINDER

Please email Post-WEBINAR questions to [mfemreite@pea-lentil.com](mailto:mfemreite@pea-lentil.com)

## Summary and Conclusions

- Pulses represent a very environmentally friendly and sustainable food source.
- Pulses are rich sources of high-quality and cost-effective protein ingredients.
- Consumers actively look for protein in foods.
- Pulse proteins do not require allergen warning labels on food packages.
- Pulse proteins will reproduce most or all of the functional properties of other food protein ingredients, depending upon the application.
- Product applications:
  - Layer cake: pulse proteins can replace 100% of egg or milk ingredients, but need a gelling ingredient (e.g. pea starch) to help stabilize foam.
  - Cookies: pulse proteins can replace 100% of egg or milk ingredients.
  - Pasta: pulse flour and protein can replace 100% of wheat in formula.
  - Fried meats and vegetables: pulse flours and proteins can replace 100% of egg in batters and egg washes.
  - Beverages: pH is critical.

## Additional Resources

- **The USA Dry Pea and Lentil Council**

**Contact:** MacKenzie Femreite  
**Email:** [mfemreite@pea-lentil.com](mailto:mfemreite@pea-lentil.com)  
**Tel.** 1-208-882-3023  
**Website:** [www.pea-lentil.com](http://www.pea-lentil.com)

- **Northern Crops Institute (North Dakota State University)**

**Contact:** Thunyaporn “Naggie” Jeradechachai  
**Email:** [T.jeradechachai@ndsu.edu](mailto:T.jeradechachai@ndsu.edu)  
**Tel.** 1-701-231-7736  
**Website:** [www.northern-crops.com](http://www.northern-crops.com)

- **BEST VANTAGE Inc.**

**Contact:** Daniel Best  
**Email:** [info@bestvantageinc.com](mailto:info@bestvantageinc.com)  
**Tel.** 1-847-714-9527  
**Website:** [www.bestvantageinc.com](http://www.bestvantageinc.com)

## Industry Resources

### **Best Cooking Pulses, Inc.**

Portage la Prairie, MB

[www.bestcookingpulses.com](http://www.bestcookingpulses.com)

### **Dakota Dry Bean, Inc.**

Grand Forks, ND

[www.dakotadrybean.com](http://www.dakotadrybean.com)

### **Fiberich Technologies, Inc.**

St. Louis Park, MN

[www.fiberichtech.com](http://www.fiberichtech.com)

### **George F. Brocke & Sons**

Kendrick, ID

[gfbrocke.com](http://gfbrocke.com)

### **Harvest Innovations**

Indianola, IA

[harvest-innovations.com](http://harvest-innovations.com)

### **Hinrichs Trading Co.**

Pullman, WA

[www.hinrichstrading.com](http://www.hinrichstrading.com)

### **Inland Empire Foods, Inc.**

Riverside, CA

[www.inlandempirefoods.com](http://www.inlandempirefoods.com)

### **SK Food International**

Fargo, ND

[www.skfood.com](http://www.skfood.com)

### **United Pulse Trading**

Bismarck, ND

[www.alliancegrain.com](http://www.alliancegrain.com)

### **Woodland Foods, Inc.**

Gurnee, IL

[woodlandfoods.com](http://woodlandfoods.com)

## For Future Reference

**A downloadable copy of this Webinar presentation** will be posted on the USA Dry Pea & Lentil Council website in the near future @ [www.pea-lentil.com/webinars](http://www.pea-lentil.com/webinars). We will send webinar registrants an email notification when it becomes available.

**Upcoming Webinars:** Please stay tuned for future 2013 webinar presentations on more specific uses of pulse ingredients in food product development.





# QUESTIONS?



## REMINDER

Please email Post-WEBINAR questions to [mfemreite@pea-lentil.com](mailto:mfemreite@pea-lentil.com)



**Thank You**  
for your participation



**REMINDER** Please email WEBINAR questions to [mfemreite@pea-lentil.com](mailto:mfemreite@pea-lentil.com)



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