



# 2018 | THE ALMOND CONFERENCE

INNOVATING ALMONDS FOR NEW PLANT PROTEIN  
FORMULATIONS

ROOM 314 | DECEMBER 4, 2018





# AGENDA

- **Harbinder Maan**, Almond Board of California, moderator
- **Craig Duerr**, Campos Brothers
- **Swati Kalgaonkar**, Almond Board of California
- **Chris Marinangeli**, Pulse Canada
- **Tom Velthuis**, Log5
- **Craig Duerr**, Campos Brothers



# Creating Opportunities for Pulses and Almonds: Leveraging Protein



**Christopher Marinangeli PhD, RD**

The Almond Conference

December 4, 2018

# Outline

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1. Almonds and pulses: Both contributing to healthy and sustainable dietary patterns.
2. Regulatory frameworks for protein in North America: A barrier to promoting pulses and other plant-based protein in food innovation?

### **3. Moving forward**

Almonds and pulses as complementary protein sources for claims and nutrient density.

1. Almonds and pulses: Both contributing to healthy and sustainable dietary patterns.

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## Protein: A Trending Functional Food Ingredient in Europe

Global demand for protein ingredients has greatly increased due to protein's efficiency and high nutritional value



**‘Protein is the hottest functional food ingredient trend in the United States’:  
Packaged Facts**

By Stephen DANIELLS, 23-Dec-2014



SPECIAL EDITION: PROTEIN

**Protein trends: Saturation point or just  
the tip of the iceberg?**

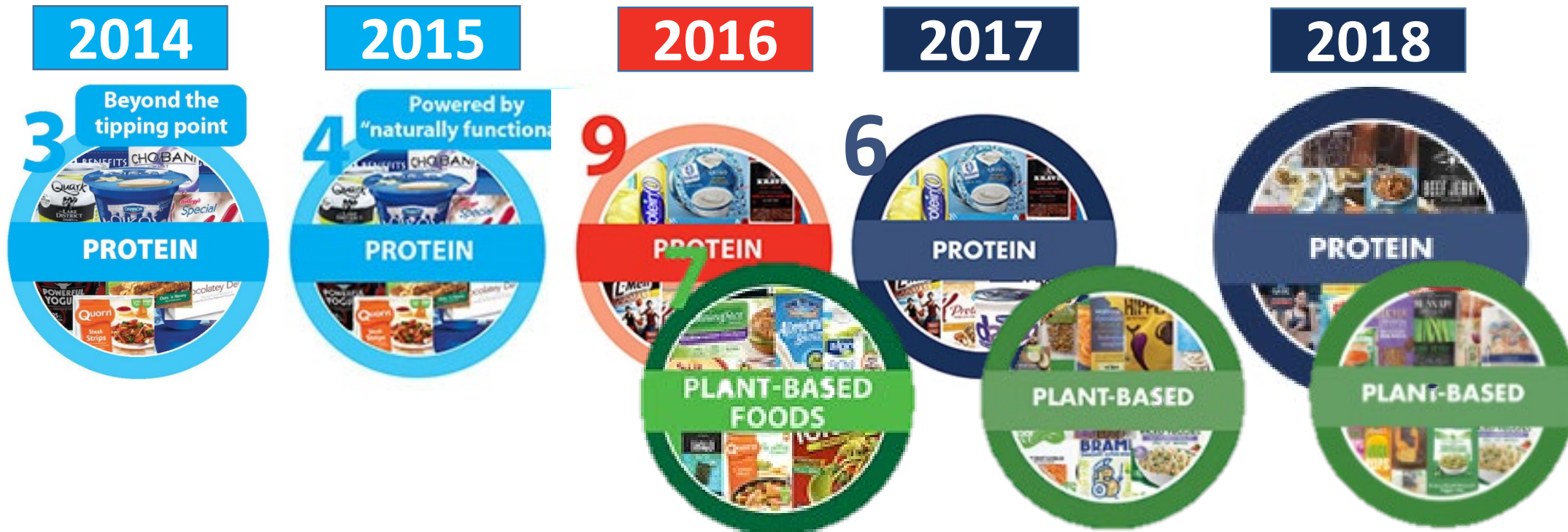
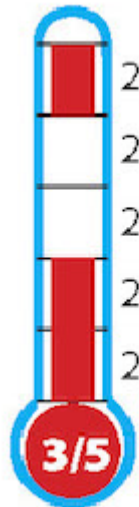


# new **nutrition** business

Strategic advice for the food and beverage industry

## 10 Key Trends in Food, Nutrition & Health 2018

by Julian Mellentin



A little something about pulses....



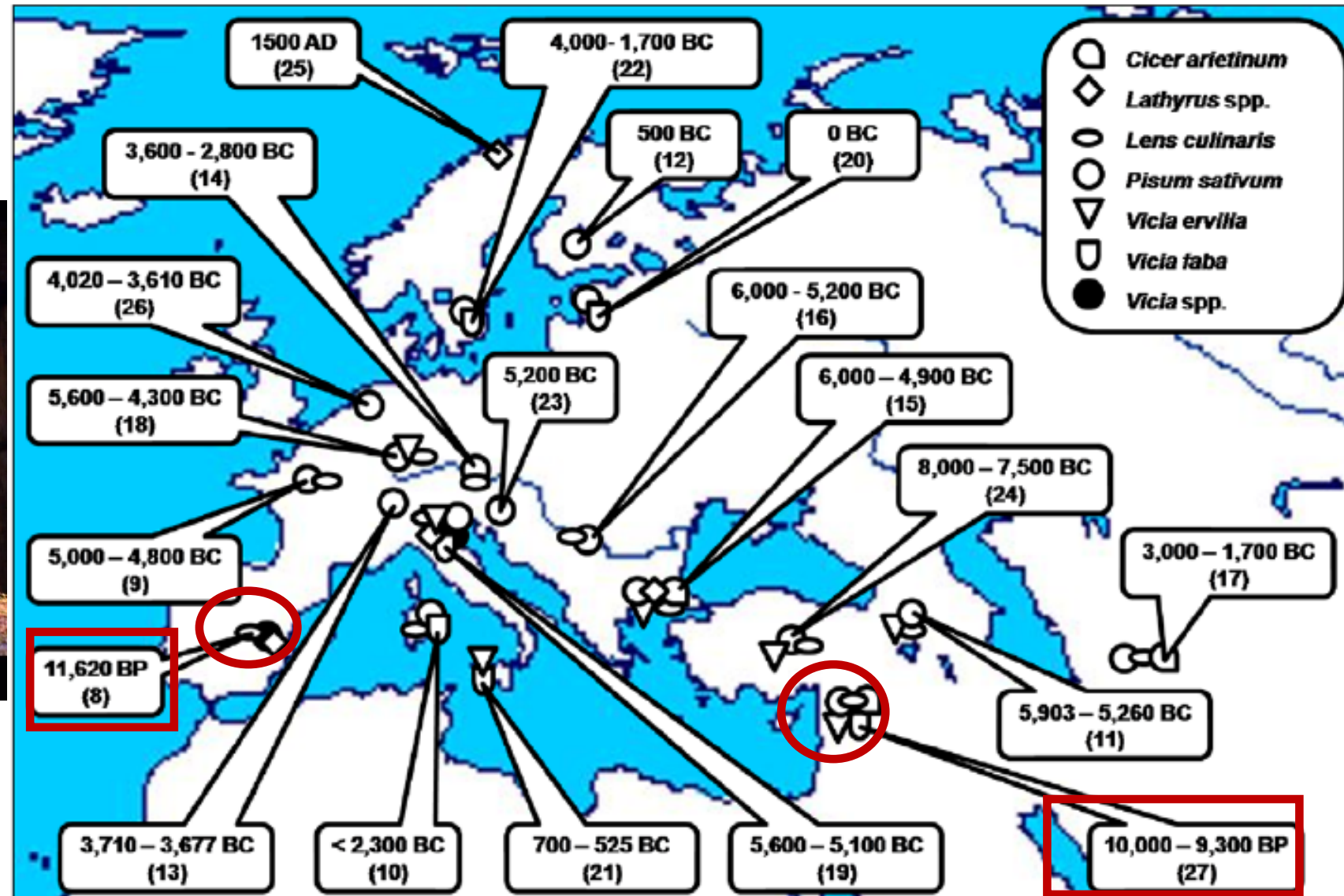
# Origin of the Words Denoting Some of the Most Ancient Old World Pulse Crops and Their Diversity in Modern European Languages

Aleksandar Mikić\*

Institute of Field and Vegetable Crops, Novi Sad, Serbia



Lentils



Pulse Type	Protein (g)	Fibre (g)	Folate (mcg)	Iron (mg)	Potassium (mg)	Magnesium (mg)	Zinc (mg)
<i>per 100 g (cooked)</i>							
Beans	8.4	7.9	124	2.2	412	54	1.04
Lentils	9.0	7.9	181	3.33	369	36	1.27
Chickpeas	8.9	7.6	172	2.89	291	48	1.53
Peas	8.3	8.3	65	1.29	362	36	1.00
Barley	2.3	2.5	16	1.3	93	22	0.82
Corn	3.1	2.8	31	0.6	251	29	0.62
Whole Grain Rice	2.6	1.5	4	0.4	43	43	0.71
Quinoa	4.4	2.8	42	1.5	172	64	1.09

A similar story for almonds ...





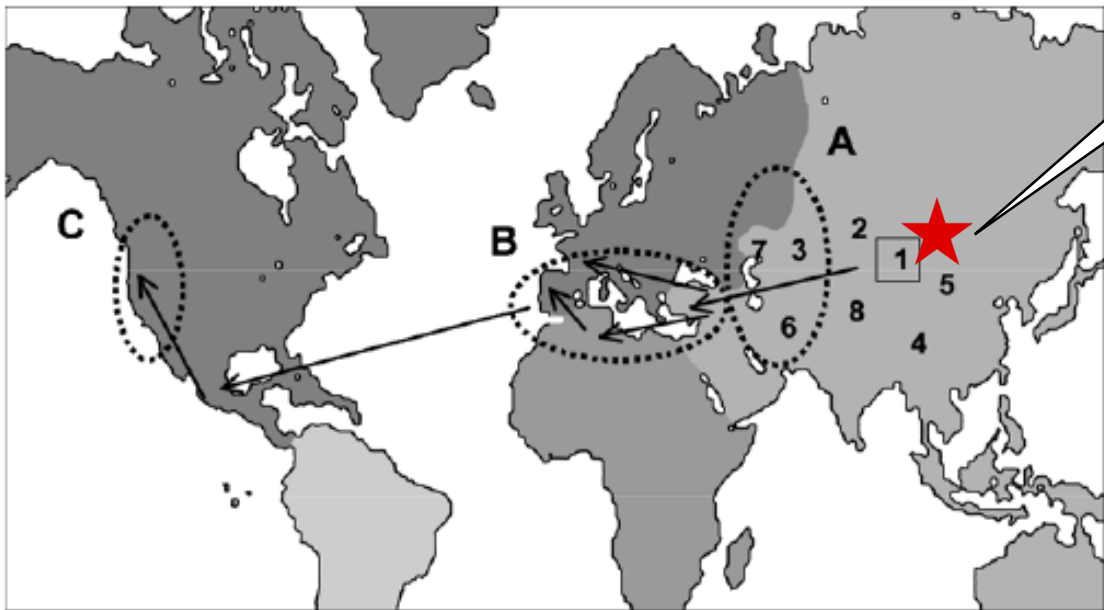
**A. Californian**

**B. Mediterranean**

**A. Asiatic**

(19,000 BP)

*Prunus dulcis*



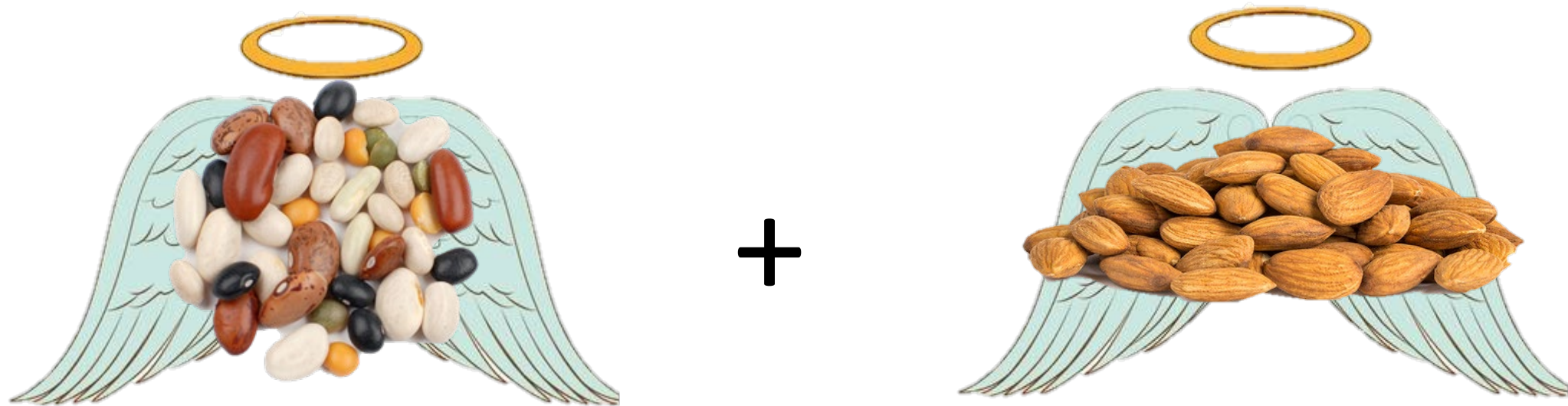
Remains of domesticated  
almonds: ~3200 bp



Pulse Type	Protein (g)	Fibre (g)	Folate (mcg)	Iron (mg)	Potassium (mg)	Magnesium (mg)	Zinc (mg)
<i>per 100 g (cooked)</i>							
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Chickpeas	8.9	7.6	172	2.89	291	48	1.53
Peas	8.3	8.3	65	1.29	362	36	1.00

Pulse Type	Protein (g)	↓	Mono + poly FA (g)	↓	Potassium (mg)	Magnesium (mg)	Zinc (mg)
<i>per 30 g</i>							
Almonds	6.3		13.16		220	81	0.94

# Match Made in Heaven?



Properties of dietary interventions (listed in the order they are presented in the text)

Dietary interventions	A1C	CV benefit	Other advantages
Dietary patterns of specific foods			
Dietary pulses/legumes	↓ (176)	↓CVD (181)	↓Weight (179), ↓LDL-C (177), ↓BP (178)
Fruit and vegetables	↓ (183,184)	↓CVD (79)	↓BP (186,187)
Nuts	↓ (188)	↓CVD (143,181)	↓LDL-C (190), ↓TG, ↓FPG (189)
Whole grains	↓ (oats) (194)	↓CHD (99)	↓LDL-C, FPG (oats, barley) (57,193)
Dairy	↔	↓CVD (199,200)	↓BP, ↓TG (when replacing SSBs) (197)





## “Source of ...”

## 2. Regulatory frameworks for protein nutrient content claims in Canada:

# A barrier to promoting pulses and other plant-based protein?

# Using Nutrient Content Claims to Transition the Protein Trend into an Opportunity for Consumers

European Commission



Government  
of Canada



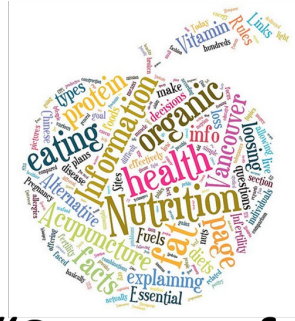
FOOD STANDARDS  
Australia New Zealand  
Te Mana Kounga Kai – Ahitereiria me Aotearoa

# Transitioning the Trend to an Opportunity for Industry and Canada

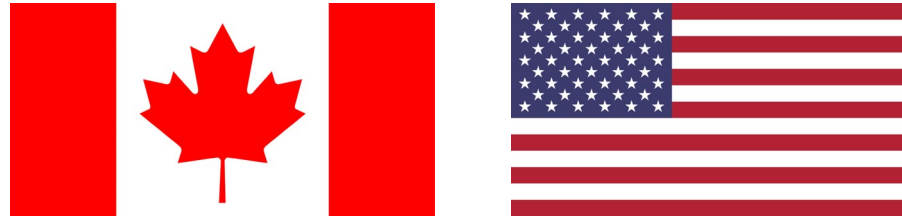


# "Source of ..."

# Positioning Plant-based Proteins as “Sources” of Protein in North America



“Source of ...”



***“Source of” Protein claims on food in Canada in the US  
are dependent on protein quality***

- Regulatory framework of nutrient content claims apply to the labelling and advertising of foods



# What is Protein Quality?

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- Describes characteristics of a protein in relation to its ability to achieve defined metabolic actions
  1. Supply of indispensable amino acids
  2. Digestibility of indispensable amino acids

## 11 Indispensable Amino Acids

- |                            |              |
|----------------------------|--------------|
| ■ Tryptophan               | ■ Threonine  |
| ■ Methionine + Cysteine    | ■ Lysine     |
| ■ Phenylalanine + Tyrosine | ■ Leucine    |
| ■ Valine                   | ■ Isoleucine |
| ■ Histidine                |              |

# Protein Quality of Animal and Plant-based Foods

## Animal –based Protein



Generally...

- ↑ Levels of protein (g)
- ↑ All indispensable amino acids
- ↑ Digestibility (>90%)

## Plant-based Protein








Generally...

- ↑ Levels of protein (g)
- ↓ 1 or more indispensable amino acids
- Moderate to ↑ Digestibility (70% to >90%)

In General, plant-based proteins have a lower protein quality compared to animal-based protein

# Limiting Indispensable Amino Acids in Almonds and Pulses (mg/g protein)

	TRP	THR	LYS	Met + Cys	ILE	Phe + Tyr	HIS	LEU	VAL
	10.0	28.4	26.9	17.6	35.5	74.8	25.5	69.6	40.4
	TRP	THR	LYS	Met + Cys	ILE	Phe + Tyr	HIS	LEU	VAL
	7.9	38.0	72.1	22.6	38.8	76.0	24.1	72.8	43.5
	8.0	42.3	81.1	17.9	38.4	84.9	26.6	80.7	43.8
	6.8	40.6	73.9	26.9	45.6	94.0	29.2	84.4	48.4
	10.4	52.6	75.6	19.2	41.8	92.3	30.5	88.5	48.9



# Protein Content Claims in Canada and US: Contingent on Protein Quality



**Protein Rating** = Adjusted Protein Efficiency Ratio (PER) x g of protein per Reasonable Daily Intake

- Bioassay
- “Good Source of Protein” = Protein Rating of 20 -39
- “Excellent Source of Protein” = Protein Rating > 40



## Protein Digestibility Corrected Amino Acid Score (PDCAAS)

Corrected Protein Level =  $PDCAAS_{Food} \times \text{Level of protein in the food (g) per RACC}$

$$\% DV = \frac{\text{Corrected protein level (g) per RACC}}{50 \text{ g DV protein}}$$

DV = 50 g protein/day

- If the %DV is  $\geq 10\%$ , the Food is a “Good” Source of Protein
- If the % DV is  $\geq 20\%$ , the Food is an “Excellent” Source of Protein



**RACC; reference amount  
customarily consumed**

# Claims for Whole Pulses and Almonds in Canada Using the PER Method



*Casein PER = 2.5 Protein Efficient ratios & protein ratings - Canadian Regulatory System					
	Protein (g/100 g)	Reasonable Daily Intake or Reference amount*	Adj. PER	Protein Rating serving	Claim
Red kidney beans	8.27	250 g	1.55	32.04625	Yes
Navy Beans	8.76	250 g	1.51	33.069	Yes
Whole green lentils	6.72	125 ml	1.3	9.1455	No
Split red lentils	7.3	125 ml	0.98	9.1532	No
split yellow peas	6.81	125 ml	1.42	10.0039	No
Split green peas	7.39	125 ml	0.86	6.5833	No
Black beans	8.39	250 g	1.61	33.76975	Yes
Chickpeas	7.57	125 ml	2.32	15.2192	No
Pinto beans	7.85	250 g	1.64	32.185	Yes
Almonds	21.15	28 g	0.4	2.4	No

\*Reasonable daily intake for baked beans is 250 g; Reference amount for all other pulses is 125 ml

If the Protein Rating is  $\geq 20$ , the Food is a "Good Source" of Protein  
 If the Protein Rating is  $\geq 40$ , the Food is an "Excellent" Source of Protein

*Adapted from Nosworthy et al. Food Sci Nutr. 2017;5:896–903.*

# Protein Content Claims in Canada and US: Contingent on Protein Quality



**Protein Rating** = Adjusted Protein Efficiency Ratio (PER) x g of protein per Reasonable Daily Intake

- Rat growth bioassay
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# Claims for Whole Pulses in the US using the PDCAAS Method



**Max PDCAAS = 1.0**

US DV protein = 50 g/day

Protein Source	PDCAAS
Wheat	0.41
Oats	0.64
Corn	0.43
Brown rice	0.59
Barley	0.55
Red kidney beans	0.55
Navy beans	0.67
Whole green lentils	0.63
Split red lentils	0.54
Split yellow peas	0.64
Split green peas	0.50
Black beans	0.53
Chickpeas	0.52
Pinto beans	0.59

	Protein (g/100 g)	PDCAAS	RACC* (g)	Corrected Protein per serving	% DV	
Red kidney beans	8.27	0.549	130	5.90	11.8%	✓
Navy Beans	8.76	0.667	130	7.60	15.2%	✓
Whole green lentils	6.72	0.628	90	3.80	7.6%	✗
Split red lentils	7.3	0.538	90	3.53	7.1%	
split yellow peas	6.81	0.643	90	3.94	7.9%	
Split green peas	7.39	0.5	90	3.33	6.7%	
Black beans	8.39	0.534	130	5.82	11.6%	✓
Chickpeas	7.57	0.519	90	3.54	7.1%	✗
Pinto beans	7.85	0.59	130	6.02	12.0%	✓
Almonds	21.15	0.33	30	2.01	4.1%	✗

\* Reference Amount Customarily Consumed (RACC) assumed to be 130 g for beans and 90 g for all other pulses





Whole Yellow Pea



Split Yellow Pea



Whole Green Lentil



Chickpeas



Pinto Beans



Black Beans



Navy Beans

### 3. Moving forward

Almonds and pulses as complementary protein sources for claims and nutrient density.

# Protein Quality

## Animal –based Protein



Generally...

- ↑ Levels of protein (g)
- ↑ All indispensable amino acids
- ↑ Digestibility (>90%)

## Plant-based Protein



Generally...

- ↑ Levels of protein (g)
- ↓ 1 or more indispensable amino acids
- Moderate to ↑ Digestibility (70% to >90%)

**Use “Complimentary Proteins” to  
↑ the Protein Quality**

(mix different protein sources together to make up for shortfalls in Indispensable Amino Acids and Digestibility)

# Reformulation for Complimentary Protein Quality?



+



Whole Yellow Pea



Split Yellow Pea



Whole Green Lentil



Chickpeas



Black Beans

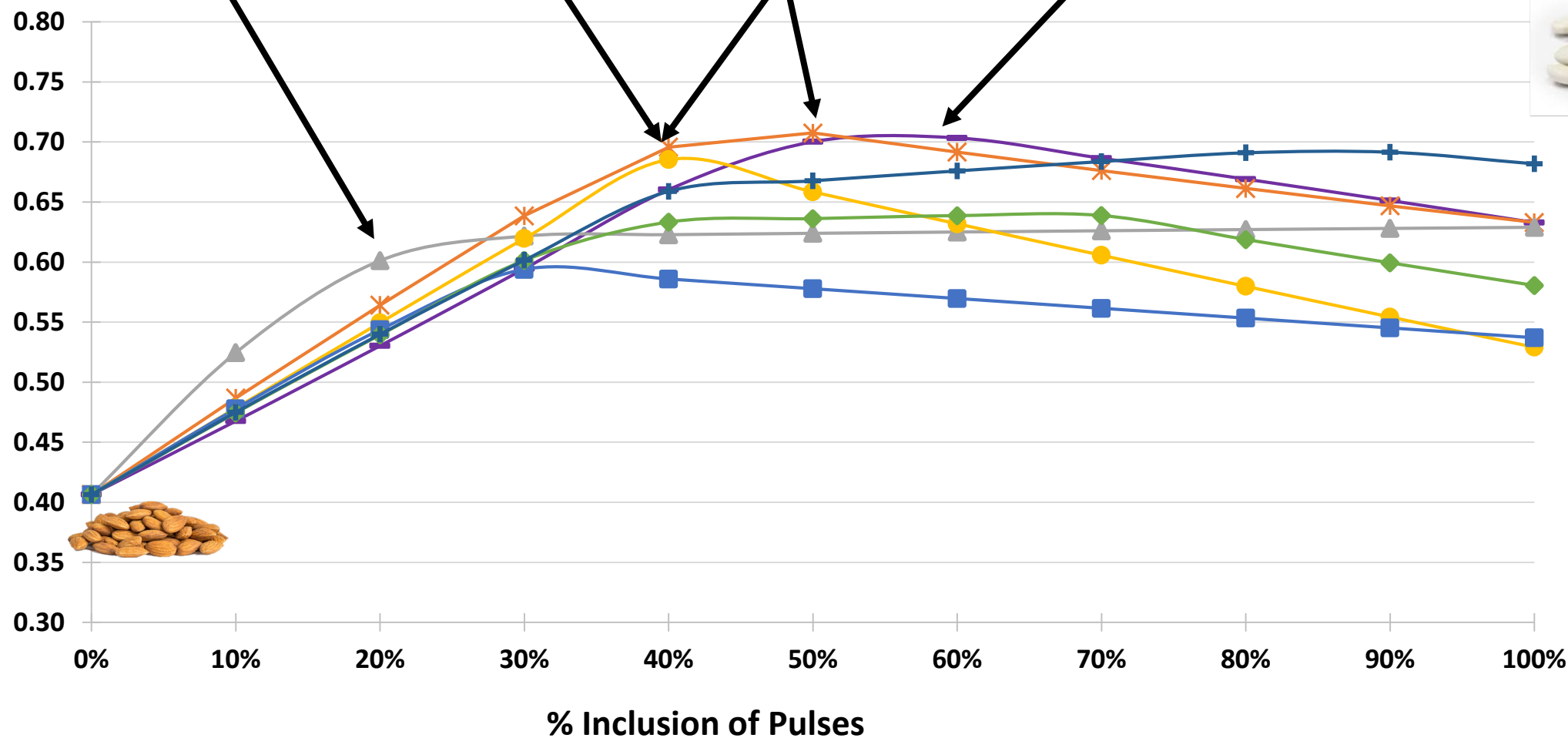


Pinto Beans



Navy Beans

# Protein Digestibility Corrected Amino Acid Score (PDCAAS)



Whole Green Lentil



Chickpeas



Split Yellow Pea



Whole Yellow Pea

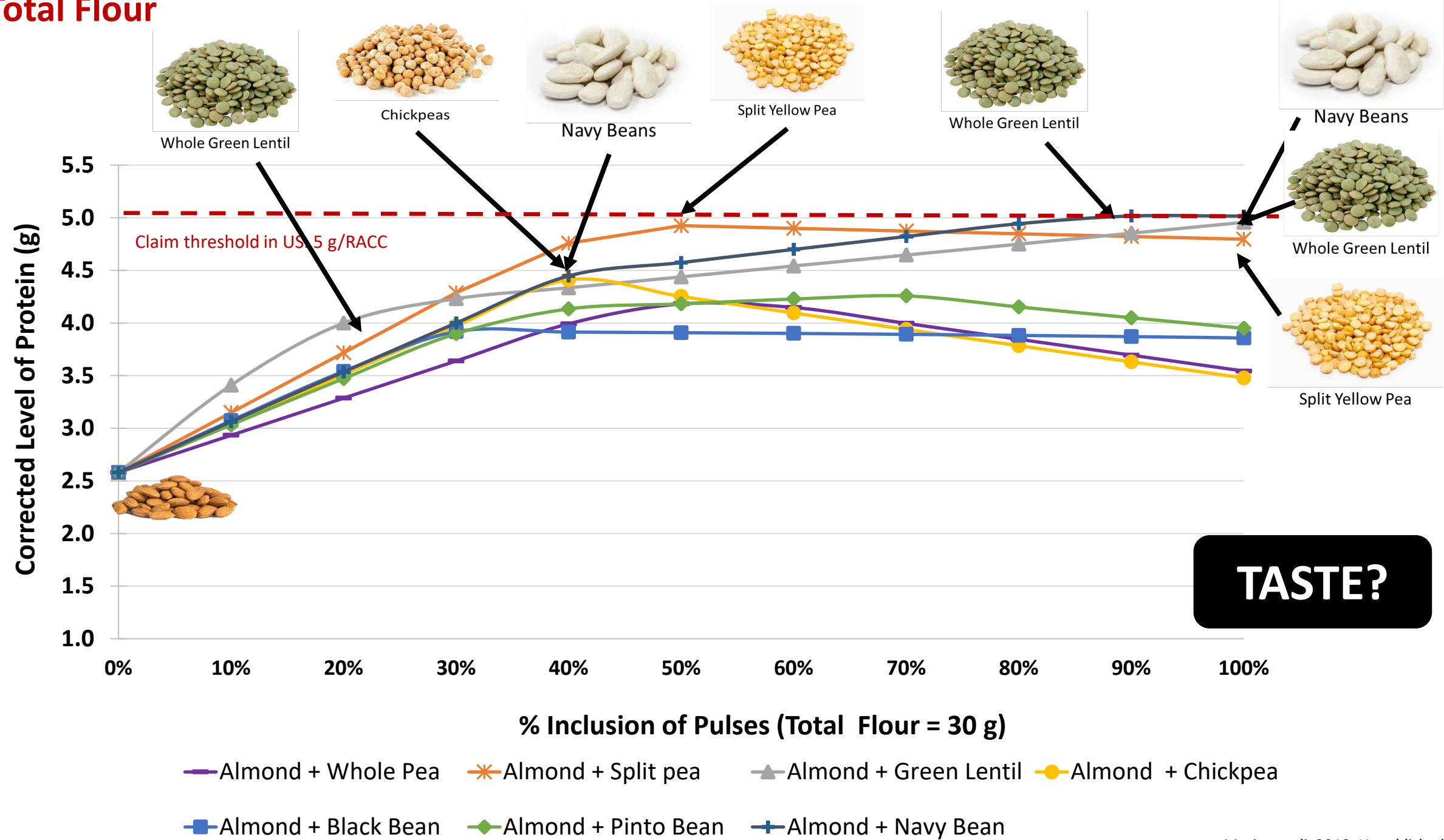


Navy Beans





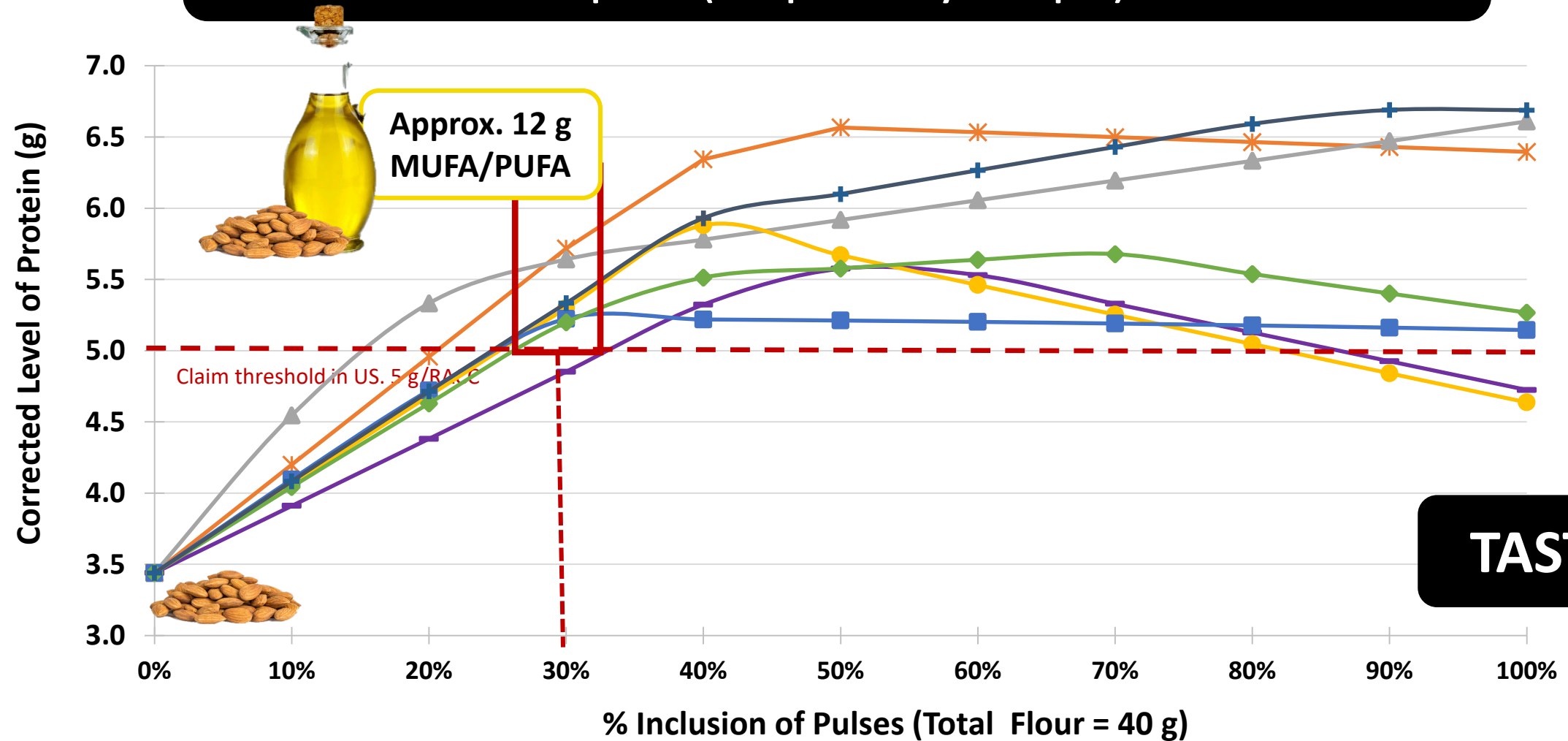
30 g Total Flour



# 40 g Total Flour

## 40 g Total Flour

- 70% Almonds + 30% pulses (except whole yellow pea) = Protein Claim



TASTE?

- Almond + Whole Pea
- Almond + Split pea
- Almond + Green Lentil
- Almond + Chickpea
- Almond + Black Bean
- Almond + Pinto Bean
- Almond + Navy Bean

# Key Takeaways

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- Almonds and pulses are nutrient dense sources of plant-based protein that contribute to healthy and sustainable dietary patterns.
- Regulatory frameworks in North America can be barriers for communicating the presence of protein in whole and manufactured foods that contain pulses.
- Combining pulses with almonds as complementary proteins can substantially increase the level of quality protein in food to help meet thresholds that permit foods to be marketed as “sources of protein.”
- The opportunity for complimentary proteins can differ depending on inclusion rates of almonds and pulses and the desired outcome.

PULSES



Thank you

Questions?



*Pulse Canada* 





# **Low fat ultrafine nut protein enhanced flour**

**Add value to Nuts & seeds**

**Almond board conference – Dec 2018**

Gerhard Knol

Product group manager Log5

MSc Food process technology

Equipment & processing Solutions

Single machine to processing lines:

- nut/seed pasteurization
- roasting
- Nut butter & spread (Nutella like products).  
Mixing, grinding and refining
- Technology center in the Netherlands

Major industrial customers





# Ultrafine low fat protein powder applications

- Confectionary industry : fillings, snacks,
  - Chocolate filling with low oil content (chocolate friendly fat bloom prevention)
  - Add ultrafine coating
- Dairy, include in milk, ice cream, yogurts etc.
- Health bars
- Instant mixes :
  - Shakes, drinks (mixtures with other (protein) sources)
  - High protein suitable for athletes..
  - Instant (pea)nut butter
  - Instant Almond (or tree nut) milk
- Smoothies
- Bakery:
  - Bake stable
  - Gluten free flour, all natural



# Product: Ultrafine low fat protein powder

- Calibrate (low) fat content in (tree)nuts & seeds (repeatable)
- Create a dry flour
- Low in fat, high in valuable proteins
  - $\approx 12\%$  fat,  $\approx 40\%$  protein (Brown, calculation USDA table brown 12061)
  - $\approx 12\%$  fat,  $\approx 43\%$  protein (Blanched, calculated from USDA 12062)
  - Non-chemical (no Hexane / Alcohol / CO<sub>2</sub>)
- Ultra fine: very smooth texture – similar to cocoa powder (down to 20 micron)
- “Cold pressed” high quality unrefined oil

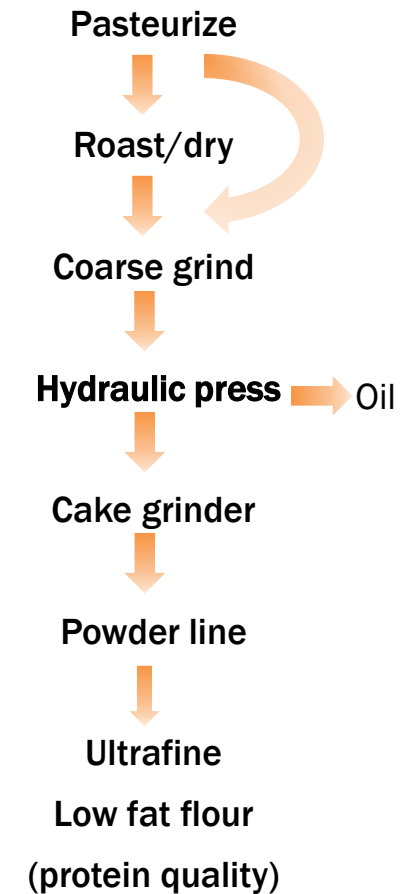
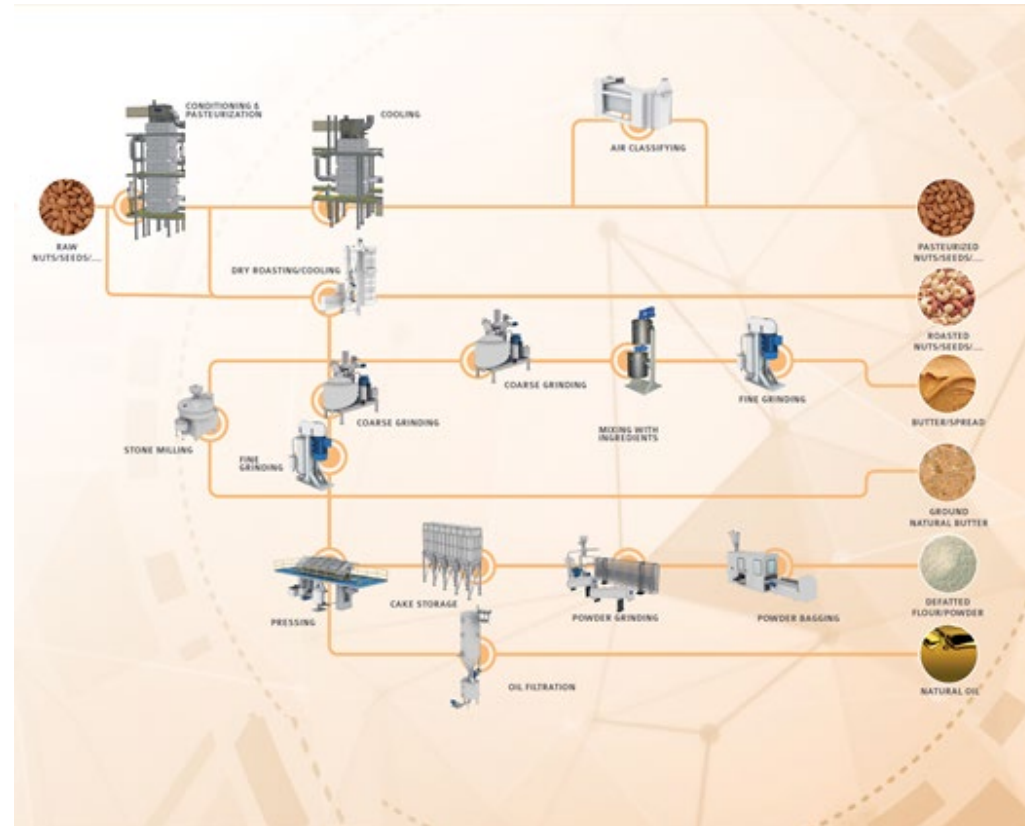
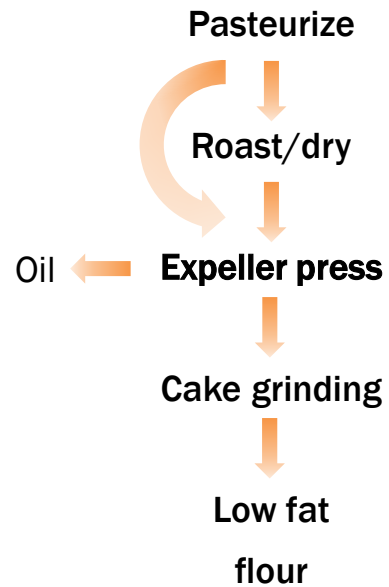




- Ground material
  - Brown or white almonds
  - Use wholes / pieces / slivers
  - Raw dried (Pasteurized with raw quality)
  - Roasted
- Product development in our technology center



Two technologies : different focus

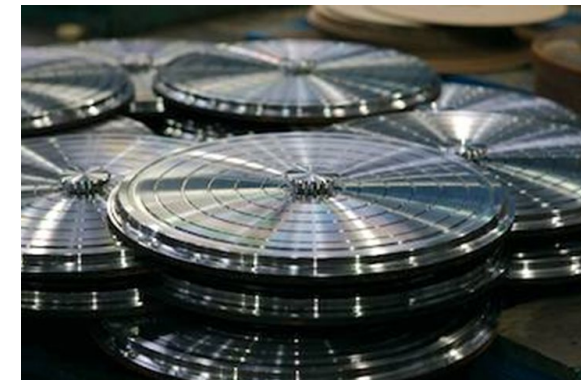


## Expeller press

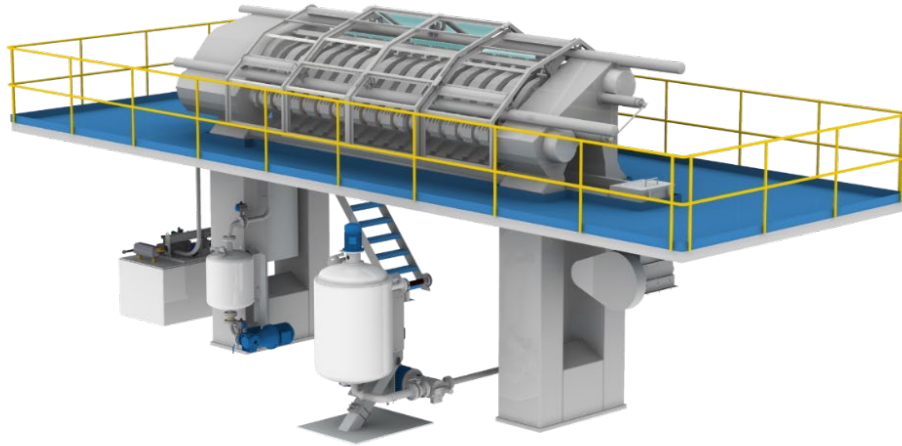
- Efficient oil production
- Warm (high friction/shear)
- Infeed solid particles
- Low capital investment
- Wear & tear
- Continuous adjustment
- Cleaning attention point
- **Coarse powders** (impact shear / heat)
  - Issues with solubility
- Variation in oil content
- Upgrade low value by streams

## Hydraulic press

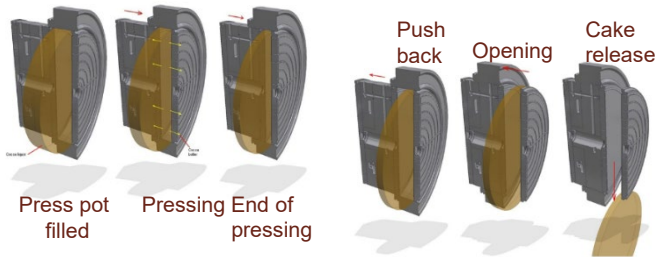
- Efficient solids production minimal impact
- Cold (no friction/shear)
- Infeed (tree)nut butters (pump able)
- Higher capital investment
- Low maintenance
- Repeatable results
- Sanitary production
- **Ultrafine protein powders** down to 20 micron
  - High solubility /flowability / mixing properties
- Calibrated repeatable oil content (12 – 28%)
- Upgrade “waste” product



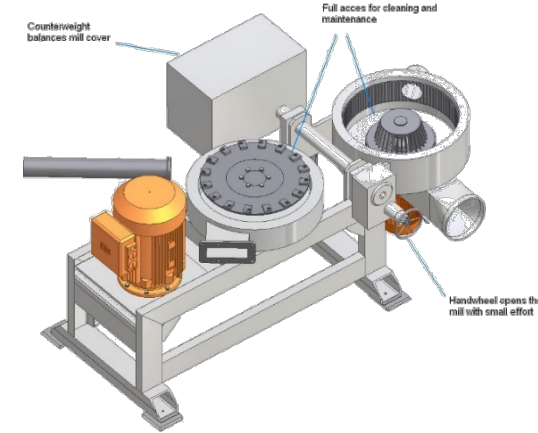
# Cake processing



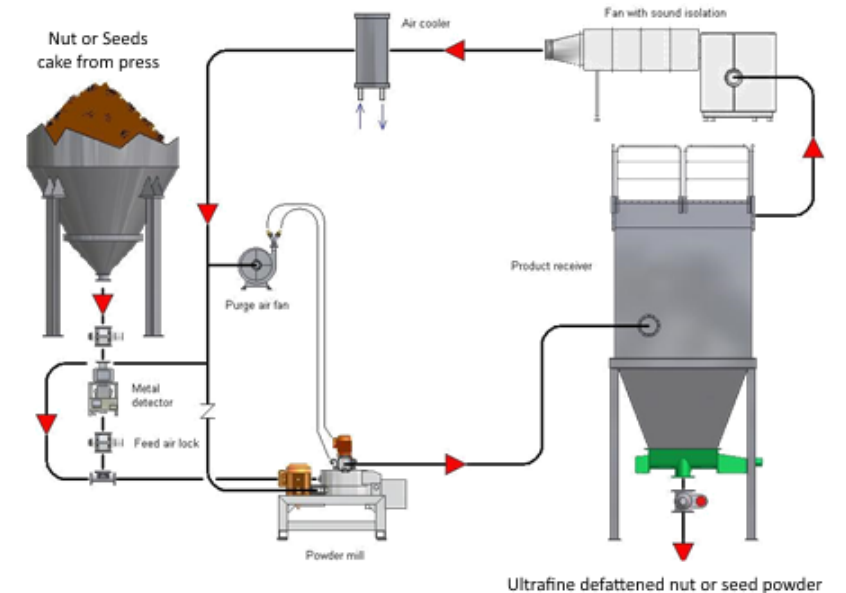
Pressing/opening sequence



>15,000 PSI frictionless force  
on the product to take the oil out and  
leave behind the solids

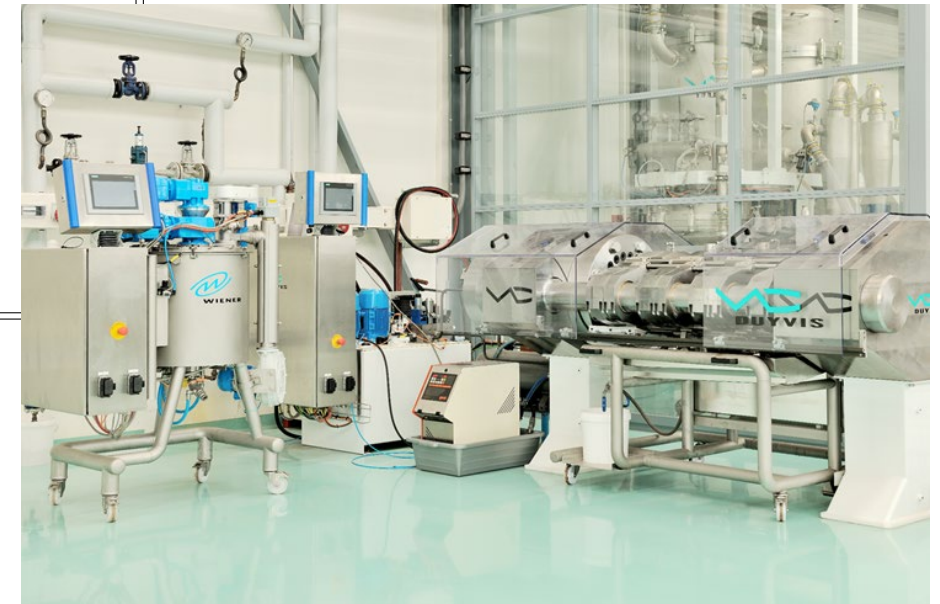
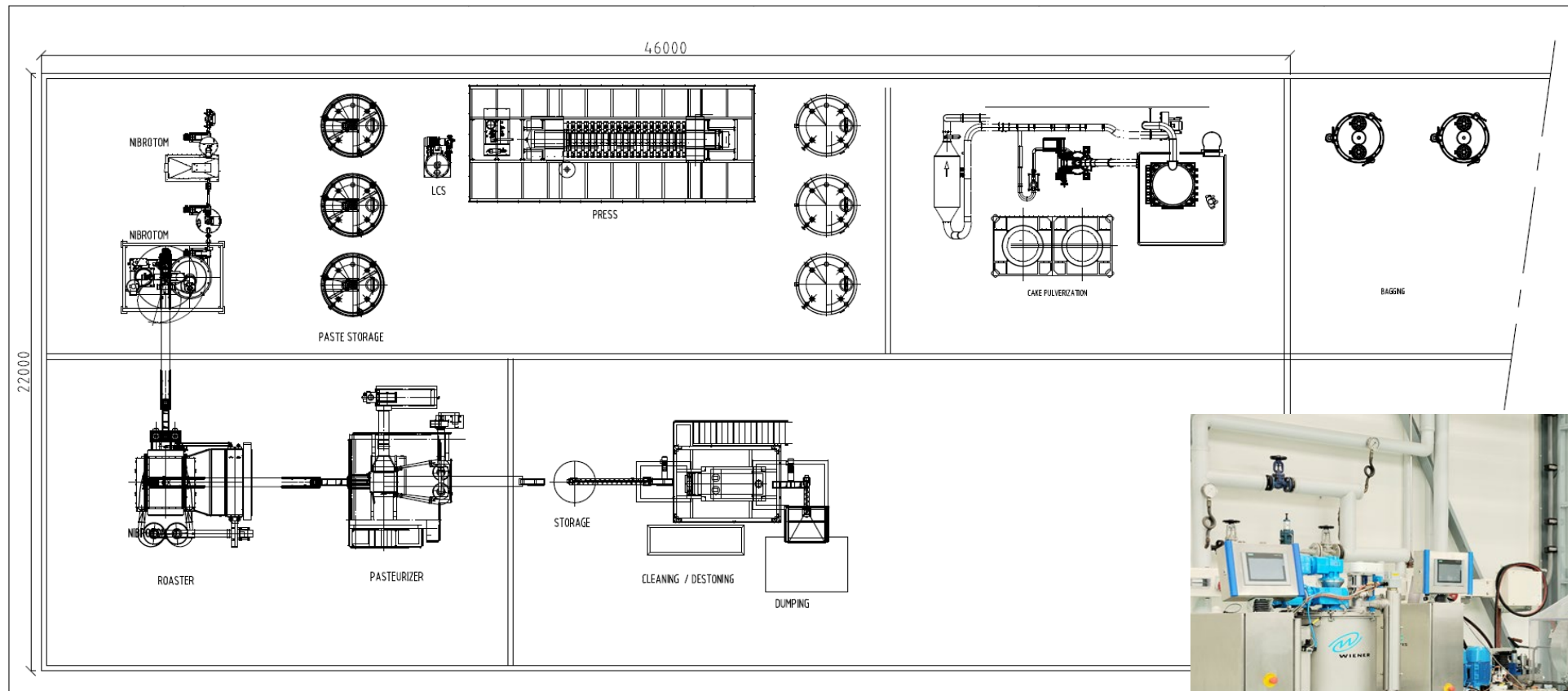


Milled to an  
exquisitely  
fine powder





# Example of layout Low fat ultrafine nut flour





- Ultrafine natural protein nut flours, for
  - Direct sell to consumers (health industry)
    - Mix with other protein sources for higher value
    - Well flavored high energy shakes
  - Ingredient :
    - Confectionary industry
    - Dairy
    - Health bars
    - Instant mixes
    - Bakery
  - Oil:
    - Cosmetic industry
    - Also interesting for (sweet goods) to bakeries!
    - Salad dressing, other consumables
- Base material for further processing steps

- (Tree)Nut industry : from agro supplier to value addition with technology
- We see increasing demand and interest for solutions for:
  - Health                      Low fat/oil
  - Natural pasteurization (safe raw food)
    - Non Chemical
    - Gentle processing (Low acrylamide)
  - Versatility                Taste / feel / color combinations with other products
  - Product diversity        More complex flavors (confectionary industry)
  - Consumer & brand        With product and process
  - Decrease ingredients    Process “base” product to make it functional
- Protein market
  - Diversification in products
  - Production at origin facility due to allergen concerns
  - Focus still on exploring opportunities
  - Mild processing in order to obtain protein and oil quality
  - Higher protein values



## More information?

**For info:**

**Gerhard Knol**

**Tom Velthuis**

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[tvelthuis@log5.com](mailto:tvelthuis@log5.com)





# Plant proteins New Product Introductions Innova Market Insights

[analyst@innovami.com](mailto:analyst@innovami.com)

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



# Eating plant-based is becoming mainstream, industry thrives on plants

## CONSUMERS MAKE HEALTHIER FOOD CHOICES

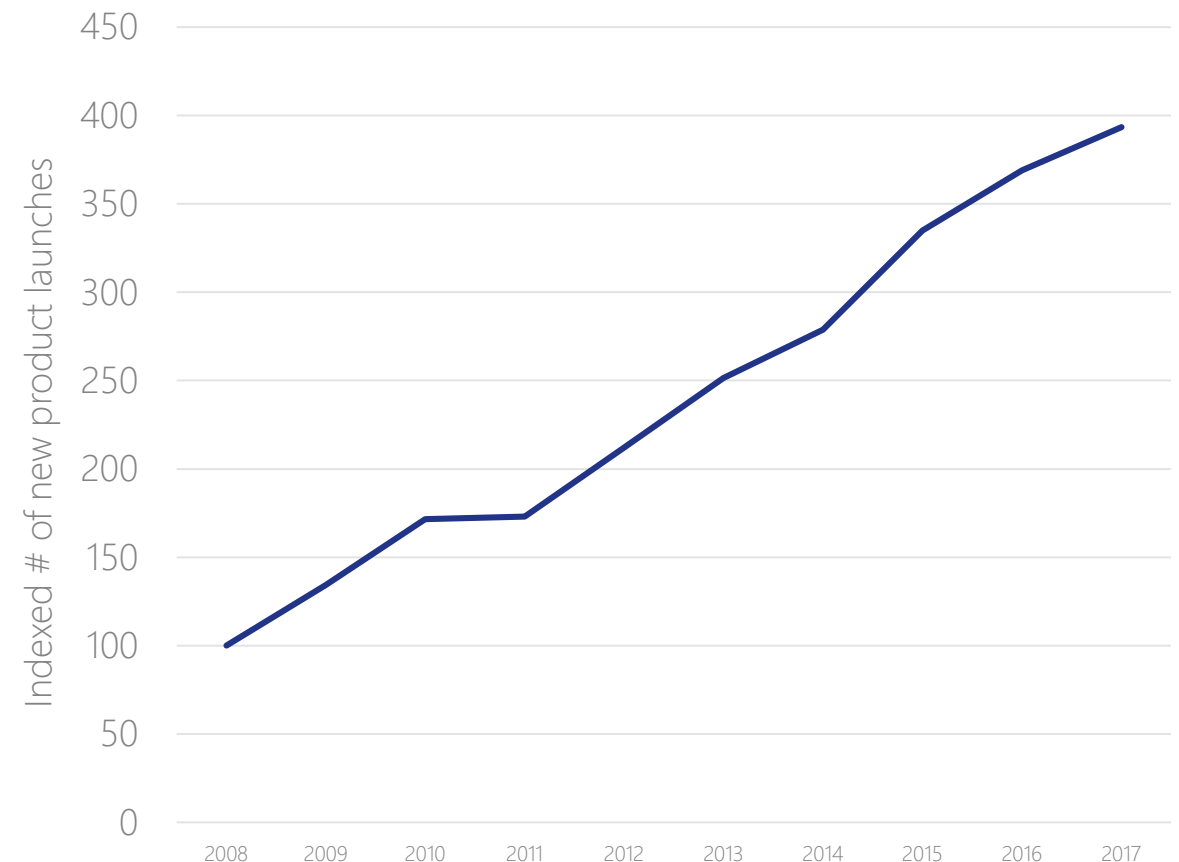
- 8 in 10 consumers\* have changed their own or family's diet to try to be healthier (2018) and over 40% of those consumers have increased their consumption of fruit & vegetables in order to be healthier.



\*Average of consumers from: UK, US, China, Brazil, France and Germany

## GROWING APPLICATIONS OF PLANT PROTEINS

Indexed number of new product launches tracked with plant proteins (Global, Indexed 2013=100)





# Almond as a clean and natural source of protein

## NATURAL PROTEIN FROM ALMONDS



### Creative Snacks Almond Clusters Baked With Cranberries and Cacao Nibs

United States, Sep 2018

DESCRIPTION Almond clusters baked with cranberries and cocoa nibs, in a 397g resealable plastic pouch.

CLAIMS **Natural protein from almonds.** No artificial anything. **5g protein per serving.** 7g sugar per serving. 4g fiber per serving. Certified kosher dairy. Real good, feel good snacks...

## ALMOND BUTTER FOR A GOOD SOURCE OF PROTEIN



### Kind Breakfast Protein Almond Butter Bar

United States, Oct 2018

CLAIMS Sustained energy from whole grains (20g per serving). **Breakfast protein 8g per serving. Good source of protein.** Gluten free. No genetically engineered ingredients. With 5 super grains (oats, millet, buckwheat, amaranth, quinoa). Certified kosher. Do the kind thing for your taste buds: Treat your taste buds to our **Almond Butter breakfast protein bars.**



# Product Examples: good source for plant protein



**Kite Hill Greek Style Artisan Almond Milk Yogurt: Blueberry**

United States, Sep 2017

DESCRIPTION Plump blueberries, **10g of almond protein** and live active cultures equals pure deliciousness by the spoonful. Comes in a plastic tray.

CLAIMS Artisan. Contains 10g almond protein. Soy and dairy free. Traditionally cultured.

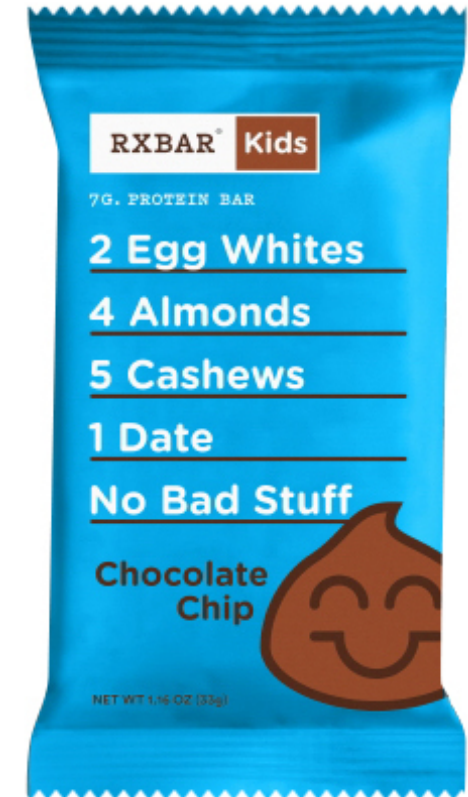


**Maxim Protein Bite With Almond Crunch Flavor**

Norway, Sep 2017

DESCRIPTION **Protein bite with almond** and a high content of natural ingredients. It contains a lot of vegan protein and fiber and is also low in sugar. Ideal before, during and after training.

CLAIMS Low sugar. Only 4g coconut sugar.



**Rxbar Kids Protein Bar With Chocolate Chip Flavor**

United States, Oct 2017



# Almond examples:



Kelloggs Special K Protein Packed With Nuts, Seeds And Almond Butter: Mixed Cereal Bars With Coconut, Cocoa And Cashew



- Super-food grains (whole rolled oats, quinoa, puffed amaranth)
- Raw sunflower seeds
- Dried shredded coconut
- Chopped raw almonds
- 15 g protein

## Kellogg's Special K Protein Bar With Blackcurrant And Pumpkin Seeds

Ireland, Feb 2018

# Nescafe: plant-based clean energy breakfast product with plant protein



- NESCAFÉ Coffee Protein Smoothie, a delicious plant-based protein coffee smoothie made with real 100% Columbian Arabica coffee, oats and almond butter to reinvent your morning routine.
- The products are expected to hit the US shelves in January 1, 2019.
- Made with 15g of plant protein, these smoothies provide fulfilling and convenient nutrition that gets you going in the morning - all with a non-dairy and no artificial sweetener formula.
- "This product taps into the rise of dairy alternative beverages and plant powered products".



Thank you  
Q and A