What's new in the plant based protein world?

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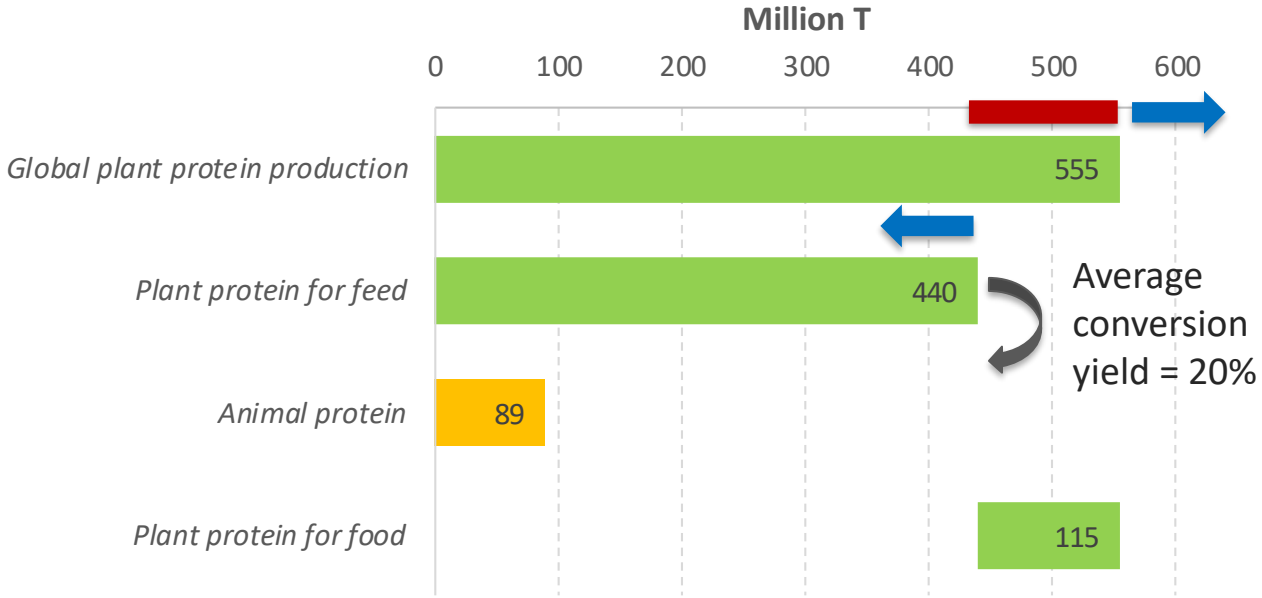
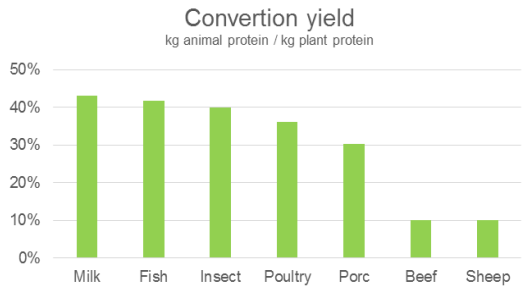
From plants to ingredients

World proteins balance: from 10 billion tons of agro material





Plant based protein ingredients will not save the world ☹

They will just make our occidental life simpler ☺

Plant sourcing: cereals

Protein content 8%

CORN (2017-18)


366 MT


257 MT


95 MT


61 MT


46 MT


26 MT

WORLD PRODUCTION : 1043 Million Tons

Sources : USDA

GMO/ Non GMO – gluten free – non allergen

Usage : corn is mainly used in the US in Feed (40%) and biofuels sectors (40%). In Europe, corn is mainly used in feed (70%)and starch industry (20%)

Protein content 12%

WHEAT (2017-18)


134 MT


99 MT


86 MT


47 MT


37 MT


32 MT

WORLD PRODUCTION : 750 Million Tons

Sources : USDA

Non GMO

Usage : wheat is mainly used in China in Feed (30%) and food, seed and industrial sectors (75%). In Europe, wheat is mainly used in feed (40%)and food (25%)

Plant sourcing: pulses

Protein content 24%

PEA (2011-2014)


3300 KT


1900 KT


1200 KT


600 KT


600 KT


550 KT


320 KT

WORLD PRODUCTION : 11 Million Tons

Sources : Terres Univia d'après Eurostat, FAO, Abare, STAT Pub et autres

GMO/ Non GMO – gluten free – non allergen

Protein content 27%

FIELD BEAN (2011-2014)


1500 KT


600 KT


400 KT


300 KT


300 KT

WORLD PRODUCTION : 4,4 Millions Tons

Sources : Terres Univia d'après Eurostat, FAO, Abare, STAT Pub et autres

Non GMO – gluten free – non allergen

Plant sourcing: pulses

LUPINE (2011-2014)

Protein content 40%


650 KT


155 KT

WORLD PRODUCTION : 1 Million Ton

Sources : FranceAgriMer, SCEES, SSP et al

Non GMO – gluten free – allergen

CHIKPEA (2016)

Protein content 22%


8000 KT


600 KT


500 KT

WORLD PRODUCTION : 14 Million Ton

Sources : FAO

Non GMO – gluten free – non allergen

ALFALFA

Protein content 24%


55 MT


1,8 MT


1,5 MT

WORLD PRODUCTION : 60 Million Ton

Sources : CIDE/USDA/Statistique Canada/China Grassland Association

Non GMO – gluten free – non allergen

Plant sourcing: oil seeds

Protein content 38%
Lipids 18%

SOYBEANS (2011-2014)


91 MT


78 MT


48 MT


13 MT


1,3 MT

Sources : FranceAgriMer, SCEES, SSP et al

WORLD PRODUCTION : 366 Million Ton

GMO/ Non GMO – gluten free

Protein content 30%
Lipids 40%

RAPESEED (2018)


23 MT


21 MT


6 MT


5 MT


4 MT

Sources : FOP

WORLD PRODUCTION : 71 Million Ton

Non GMO – gluten free

Protein content 20%
Lipids 45%

SUNFLOWER (2018)


14 MT


11 MT


9 MT

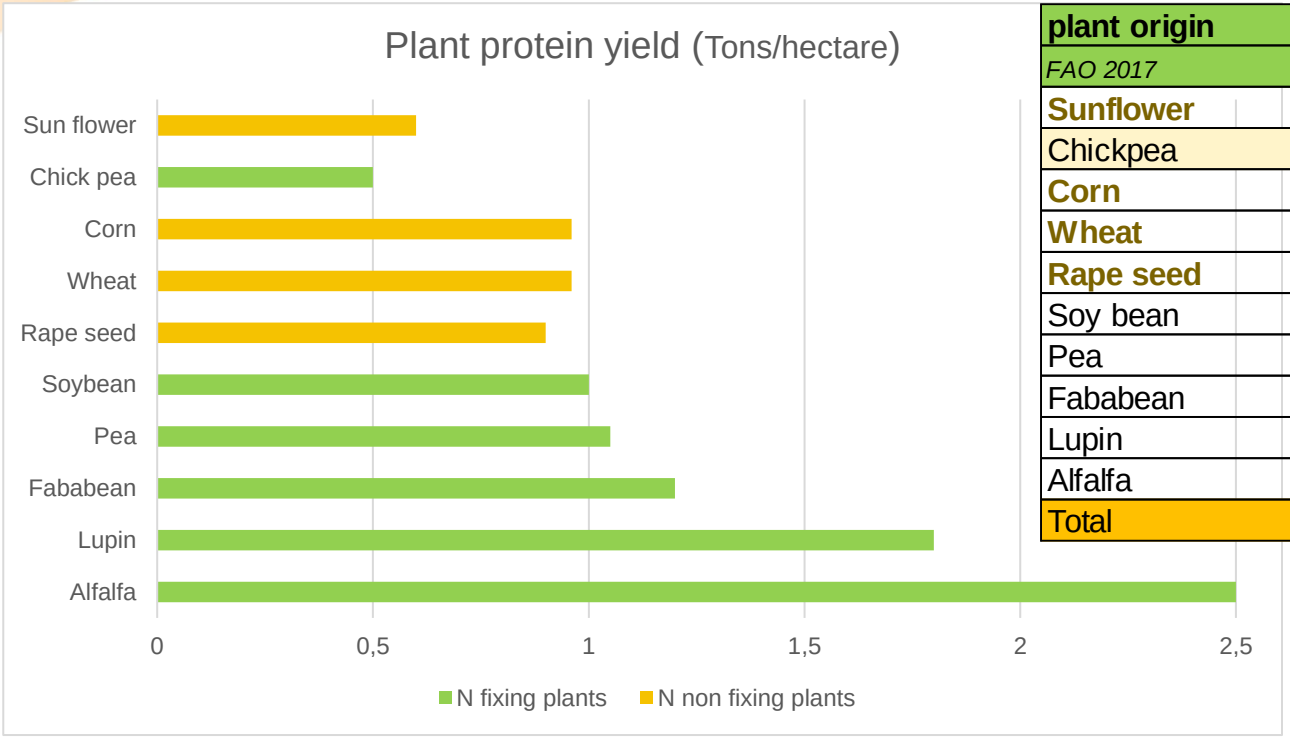

4 MT

Sources : FOP

WORLD PRODUCTION : 51 Million Ton

Non GMO – gluten free – non allergen

Plant sourcing: protein yield / hectare

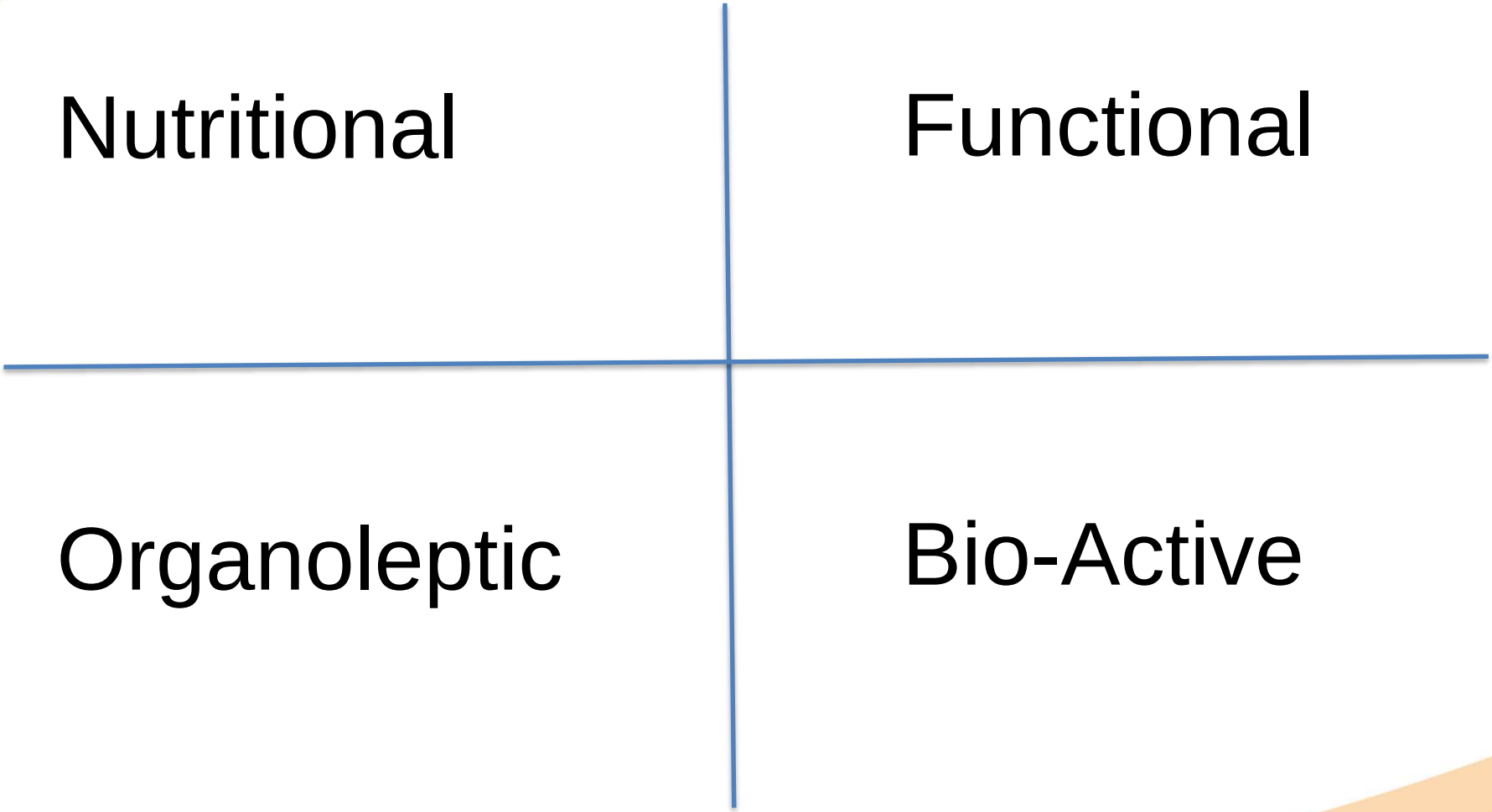


plant origin	Production	Proteines
FAO 2017	Million Tons	Million Tons
Sunflower	**51**	**9,4**
Chickpea	14,8	2,9
Corn	**1 043**	**91,8**
Wheat	**750**	**72,6**
Rape seed	**71**	**15,6**
Soy bean	366	122,4
Pea	11	2,3
Fababean	3,4	0,8
Lupin	1	0,4
Alfalfa	198	11,9
Total	2 509	330

- Nitrogen fixing plants contribute to keep the symbiotic nitrogen* high
- Symbiotic nitrogen was at 100% in 1945 it is now <5%

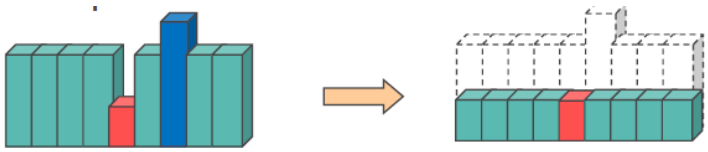
* symbiotic nitrogen is the nitrogen fixed by plants from the atmosphere and ending in the food chain.

4 complementary ways to characterize protein

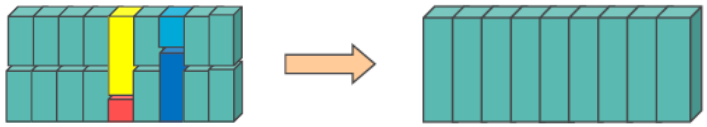


Nutritional properties

Essential AA balance



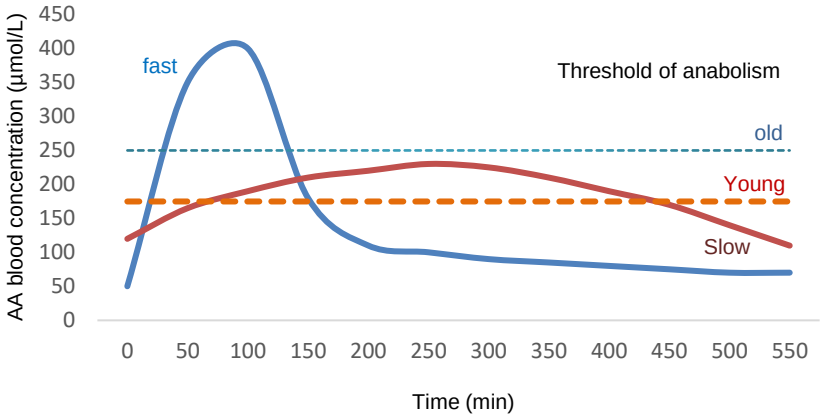
Unbalanced diet leading to AA oxidation



Well balanced diet leading to an optimal protein anabolism

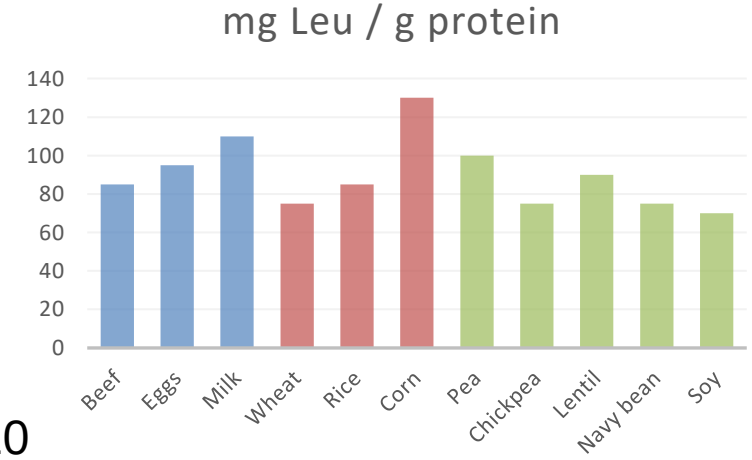
Protein digestibility: PDCAAS

Protein digestion speed

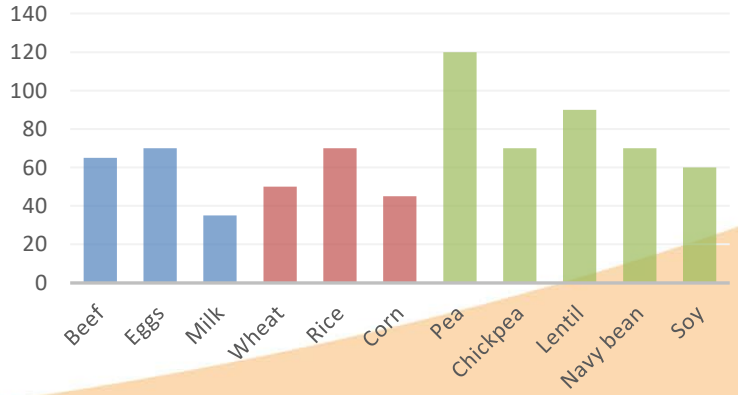


AA having messenger function

Leucine is known to stimulate protein anabolism



Arginine is known to reduce blood pressure



Functional properties

- Functional properties :
  - Don’t impact protein digestibility.
  - Help the food processing.
  - Enhance consumer pleasure.
  - Hollow to reach a higher market price than nutritional proteins.

Proteins functional properties

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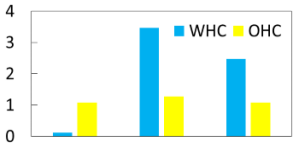
FUNCTIONAL ATTRIBUTES

WATER & OIL HOLDING CAPACITIES

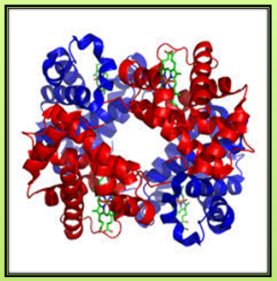


Cooked meats

FOAMABILITY

Foamscan

Mousses, desserts



INSTANT PROPERTIES

Wettability test

Instant drinks

GELLING

Texture analyser, rheometer

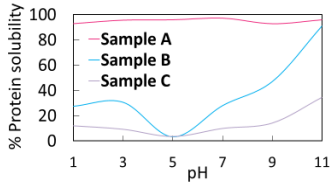
Gellies, meat replacers

EMULSIFICATION

Mastersizer 3000

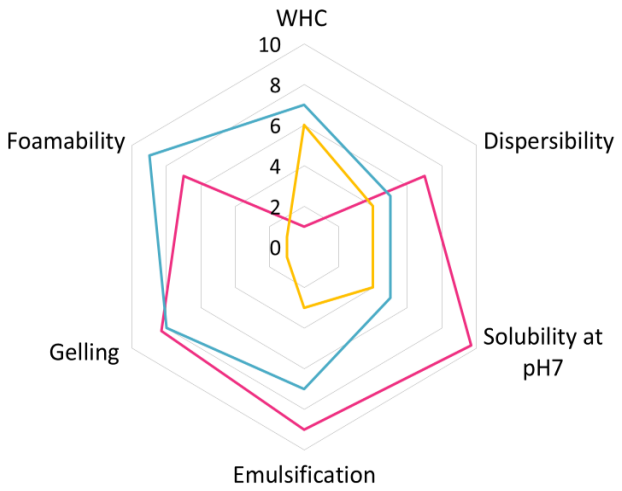
Dairy alternatives, sauces

SOLUBILITY



High protein drinks

FUNCTIONALITY SCORE



- Comparison of protein sources
- Process optimization
- Scoring and benchmarking
- animal proteins replacement

Organoleptic properties

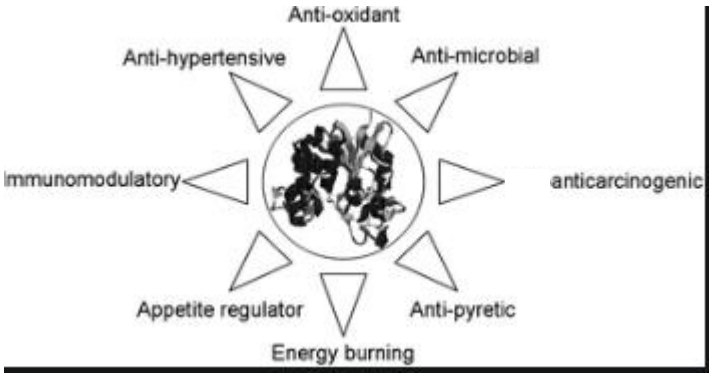
Plant proteins

- **Often associated with off notes**
  - Astringency
  - Bitterness
  - Beany, hay, cardboard aroma

- **5 strategies to deal with off-notes**
  1. Selecting favorable **raw material** (variety selection, storage conditions...)
  2. **Prevent** by processing (dehulling, enzymes deactivation, microbio control …)
  3. **Eliminate** by post processing (flash under vacuum,….)
  4. **Masking**
  5. **Formulate**

- What is perceived is most of the time a combination of aroma and taste.

Bio-active properties

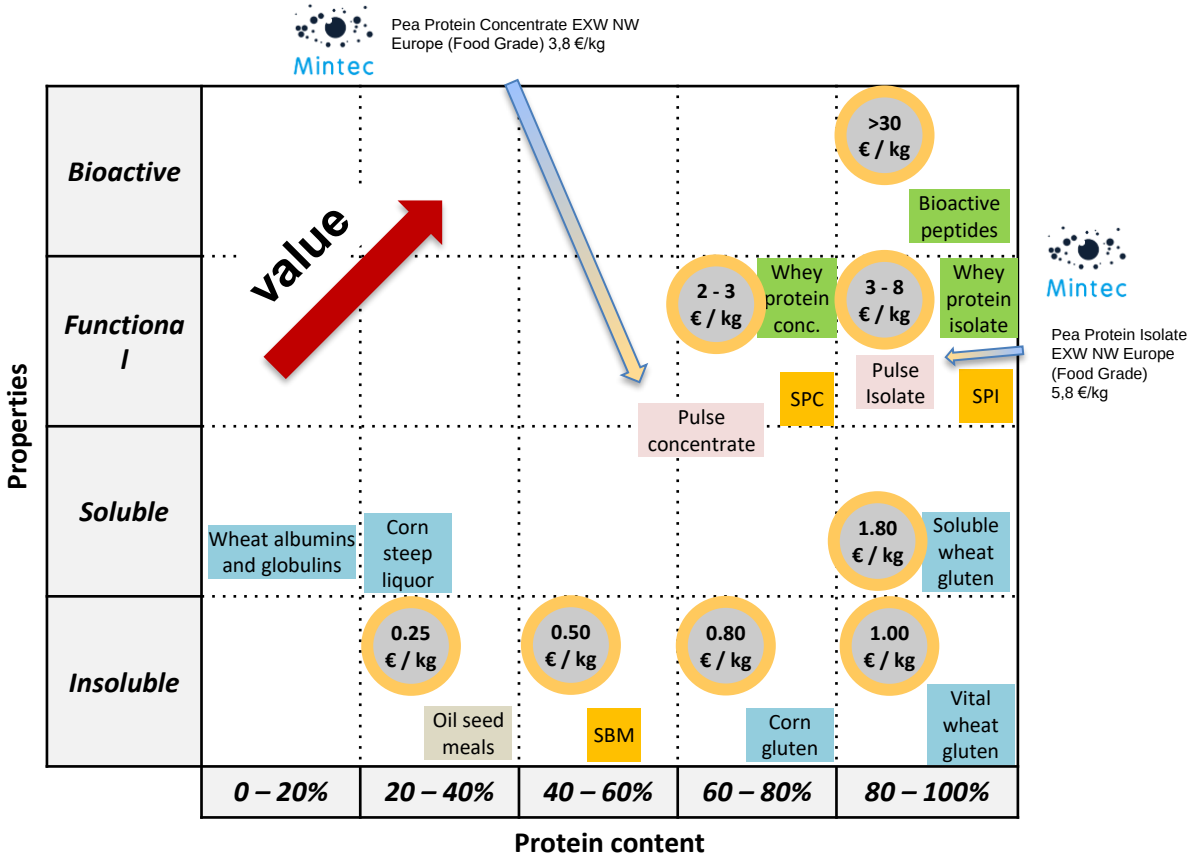


- Often linked to protein hydrolysates
- More than 30 activities impacting
  - metabolic syndrome
  - cardiovascular system
  - nervous system
  - digestive system
  - Anti microbial
  - antioxidants and anti-radicals
  - ….
- Bio-active properties can be applied in food supplement or cosmetic
- Market is characterized by small volumes high price
- Plant bio control is interested by replacing chemical by bio active protein or peptides for sustainable crop protection

Protein ingredients: 1st and 2nd generation

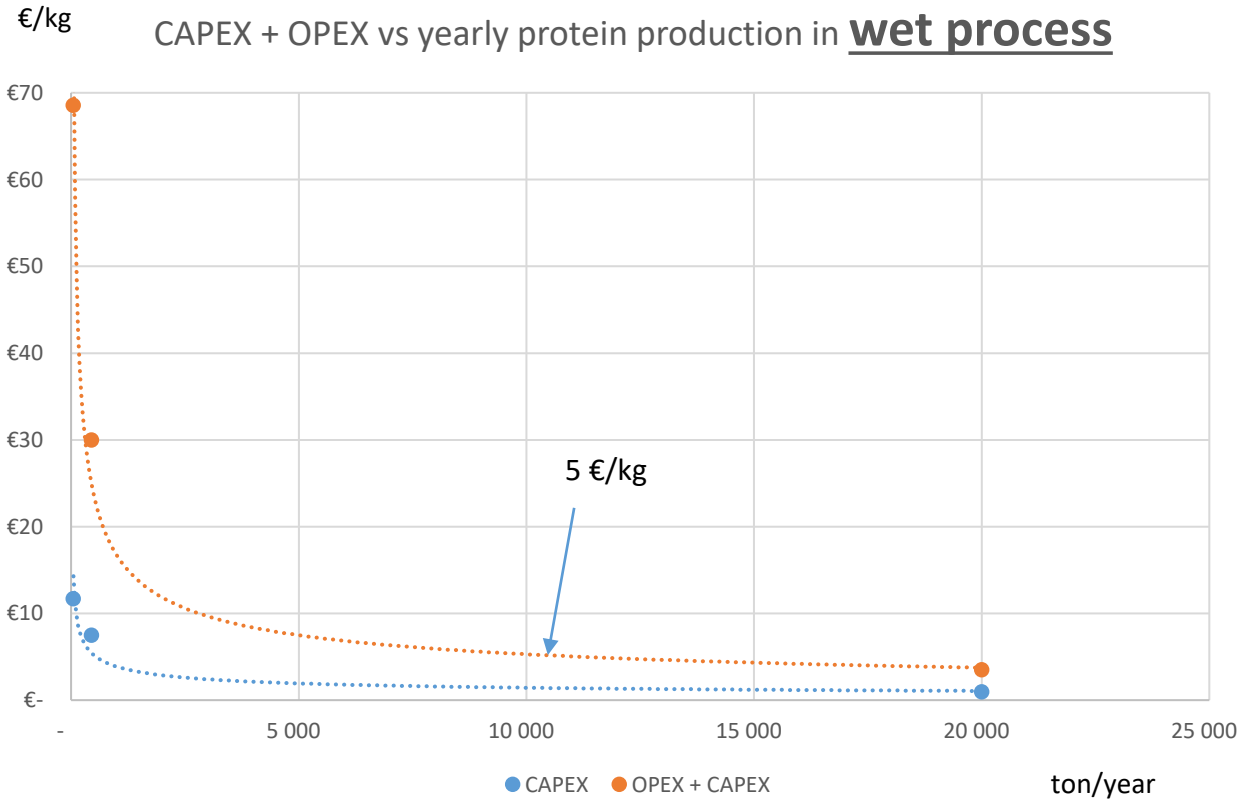
- What we see on the market today is the **1st generation** of protein ingredient with most of the time:
  - Low solubility
  - Low or medium functional properties
  - Significant off notes
- Market is adapting recipes adding functional ingredients ending to long ingredient list in final formulated products
- A **2nd generation** is coming with
  - Higher solubility
  - Higher functionality
  - Reduced organoleptic profils
- 2nd generation will become the **premium** market. 1st generation will become **commodity**

Determination of protein value



Sources: IMPROVE 2020

Determination of protein value



- **Less than 10 companies** world wide can manage wet process investments
- **Dry process** needs about 20 times less investments

Sources: IMPROVE 2019

Plant based protein sourcing

Raw material	Nb of references
Total	1019
soy	465
pea	134
wheat	123
rice	85
yeast	42
Hemp	20
potato	20
pumpkin	16
plant proteins	13
algae	12
almond	9
corn	9
faba bean	9
lupin	8
rapeseed	8
sunflower	8
sacha Inchi	5

Raw material	Nb of references
undifined	4
Lentil	3
microorganisms	3
oat	3
alfalfa	3
black bean	2
chia	2
mung bean	2
sesame	2
broadbean	1
carob	1
coconut	1
cottonseed	1
flaxseeds	1
mankai	1
psyllium	1
water lentils	1

Sources: IMPROVE 2018

By far Soy is the number 1 source of plant based protein ingredient, with 465 commercial products present on the world market, including 18 hydrolysates

- With 53 producers and 33 distributors claiming different properties:
  - Nutritional value: 140
  - Binding properties: 101
  - High solubility: 103
  - Good emulsifying properties : 95
  - Good texturizing properties : 92
  - non-GMO: 85
  - Good gelling properties : 51
  - Adding viscosity: 47
  - Good foaming properties : 8
  - Good Organic profile: 4

Main producers identified:

- ADM portfolio contains 66 products functional or not
- DuPont Danisco Solae 86 products, most of them functional
- Gushen Biological Technology Group Co., Ltd 18 products functional
- Linyi Shansong Biological Products Co., Ltd: 8 products functional + 1 hydrolysate
- PTI Group: 12 products functional
- Shandong Sinoglory Health Food Co, LTD: 11 products functional
- Shandong Wonderful Industrial Group Co., Ltd.: 9 products functional and 3 hydrolysates
- Shandong Yuxin Bio-Tech Co., Ltd.: 31 products mainly functional
- Soja Austria: 15 products mainly functional
- CHS Inc. 10 products all functional (sold since)
- Wilmar: 1 concentrate (most are sold via ADM)

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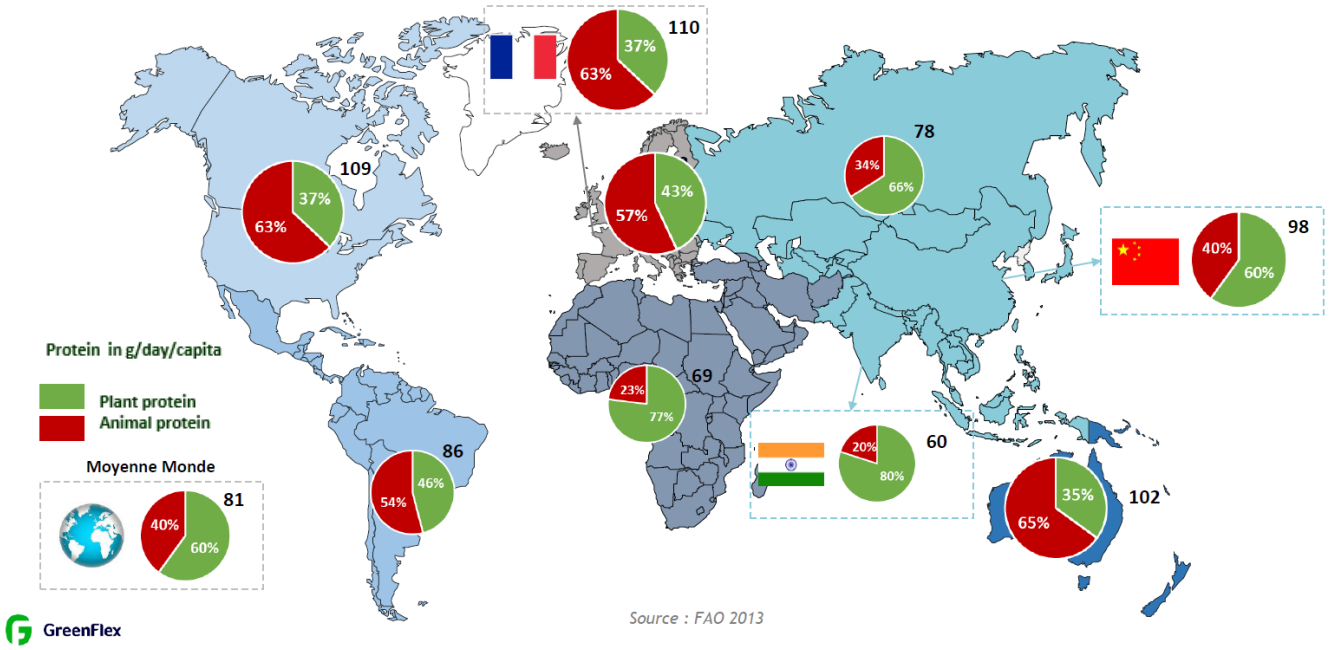
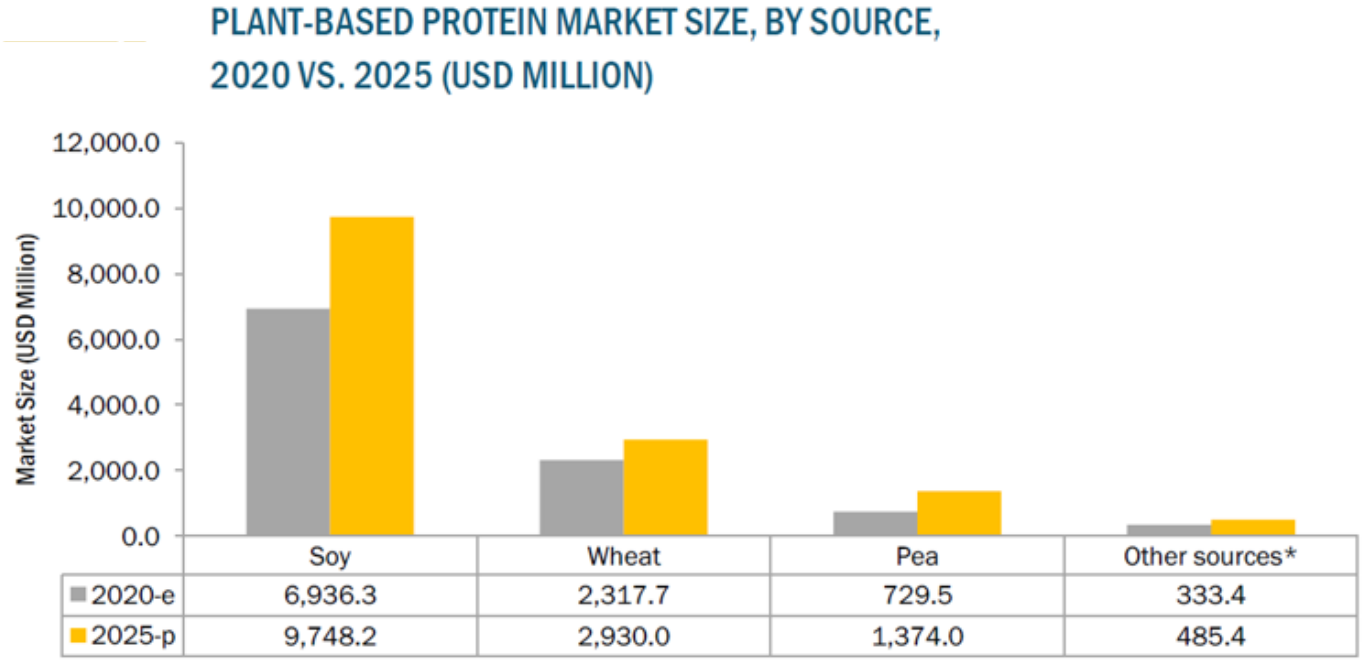
Market data

Global protein intake – plant proteins vs animal protein



- **Europe, America, Australia**: majority of **animal-based proteins**
- **Asia, Africa**: majority of **plant-based proteins**

Market trend : 10 → 14 billionUS$



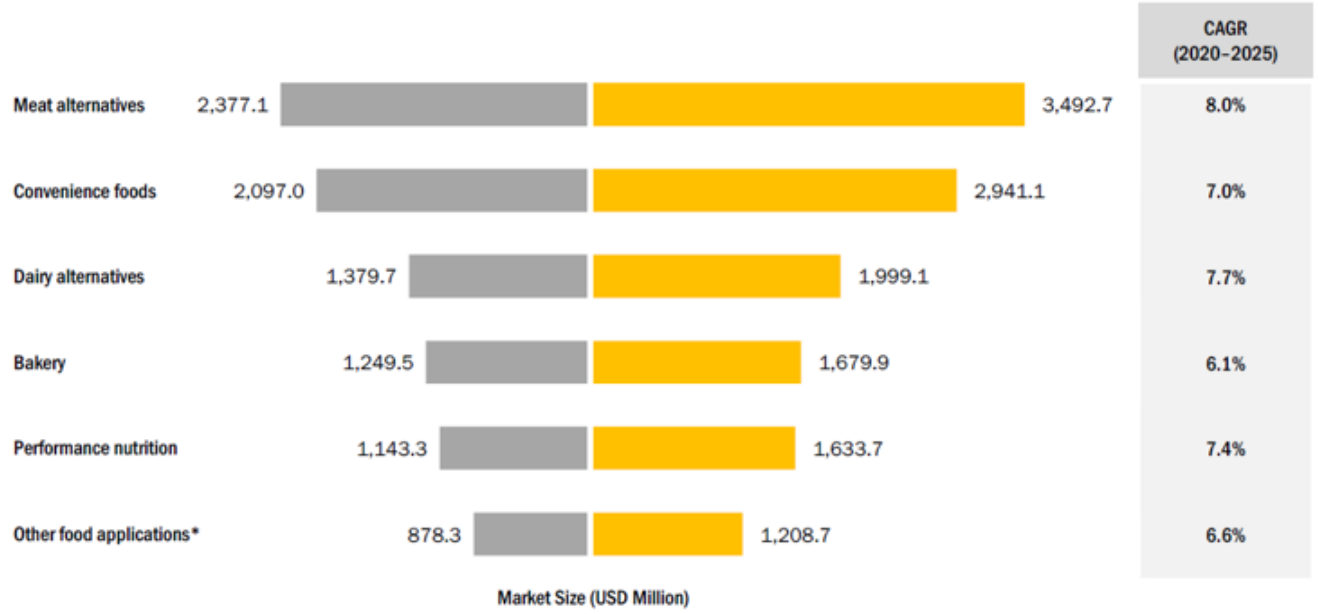
	Soy	Wheat	Pea	Other sources*
2020-e	6,936.3	2,317.7	729.5	333.4
2025-p	9,748.2	2,930.0	1,374.0	485.4

e - Estimated; p - Projected

Sources: Market&Market

Market trend

PLANT-BASED PROTEIN MARKET SIZE IN FOOD, BY APPLICATION, 2020 VS. 2025 (USD MILLION)



e - Estimated; p - Projected

Sources: Market&Market

Take-home message

- The alternative protein market is **rapidly developing** (CAGR = 7,1%)
- Plant based **protein ingredient prices** are linked to the raw material, the technology and the size of the production facility
- In a fast growing market **meat alternatives** are representing 41% of food application while **dairy alternatives** represent 15%
- 70% of the alternative protein market is in **North America & Europe**.
- **Soy** is by far the N°1 raw material for plant based proteins and still growing fast
- 2nd generation of high quality protein ingredient is developing, it will become **premium market**.

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Thank you for your attention!

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