

Veldbonen – Faba/Fava beans

from seed to society

Fred van de Velde



Fred van de Velde

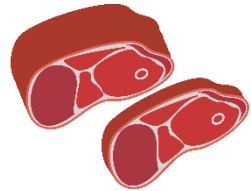
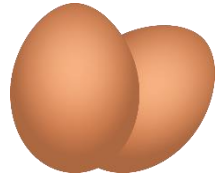
- Lector Eiwittransitie in Voeding
 - HAS Hogeschool
- Principal Scientist Protein Functionality
 - NIZO food research
- Scientific Director
 - Protein Competence Centre
- Chair Scientific & Organising Committee
 - 2nd NIZO Plant Protein Functionality Conference



Protein transition in food

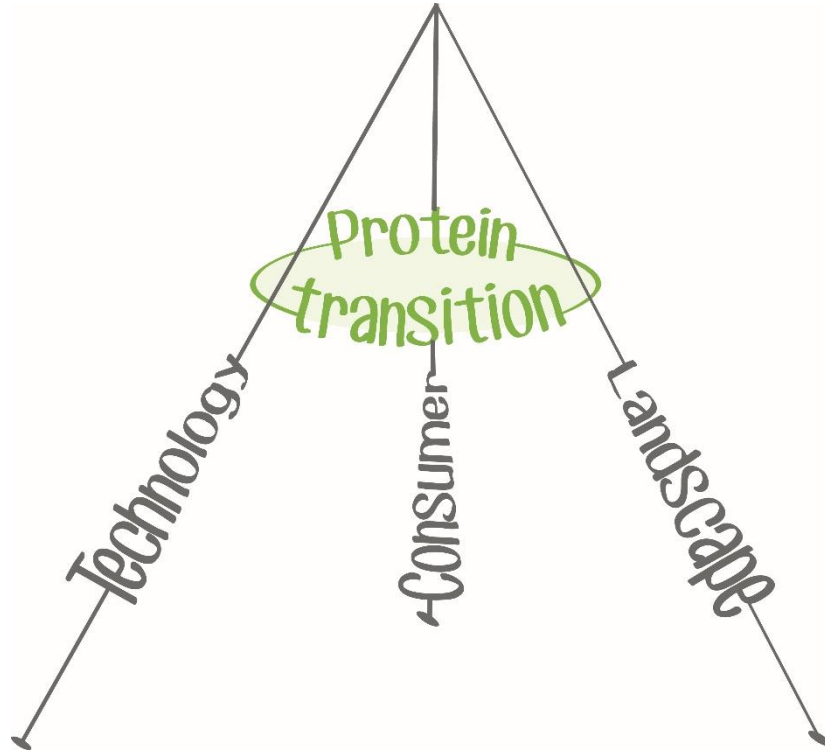
boundaries

- The transition from animal protein to plant protein
 - This is not about alternative proteins in general
- Proteins for human consumption
 - Excluding animal feed
- Insects are excluded
 - Insects are animals and do not contribute to the protein transition
- Not limited to meat replacement
 - Replacing milk, egg and meat proteins

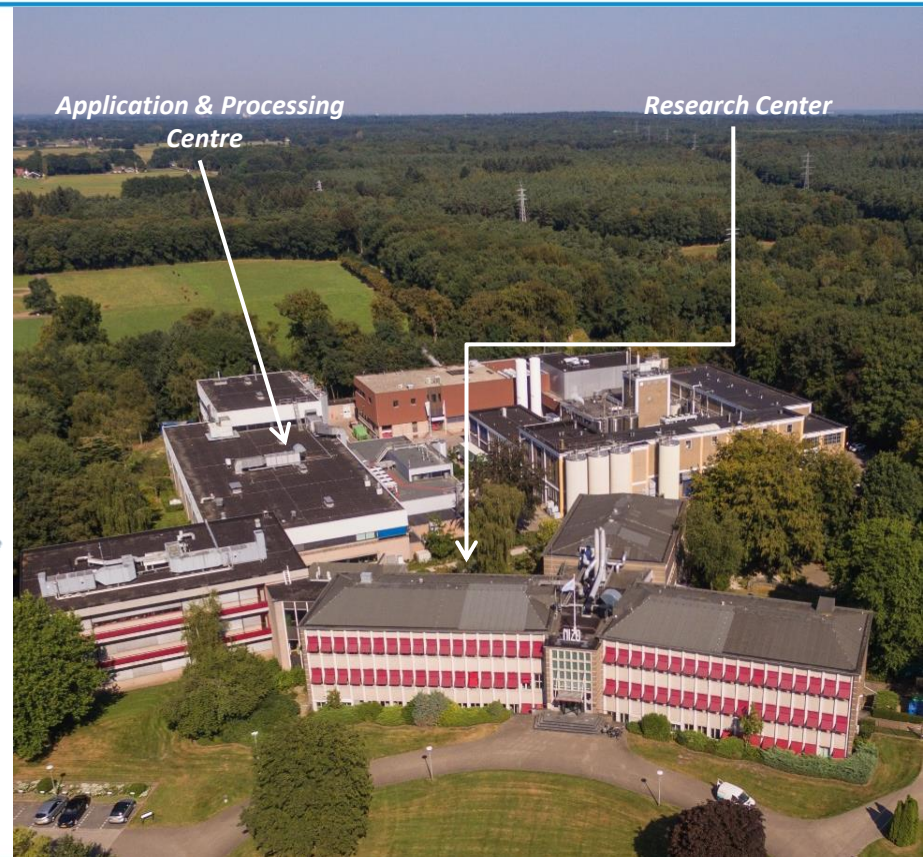
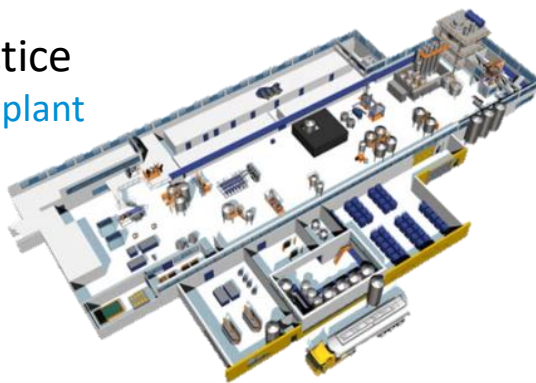


Protein transition

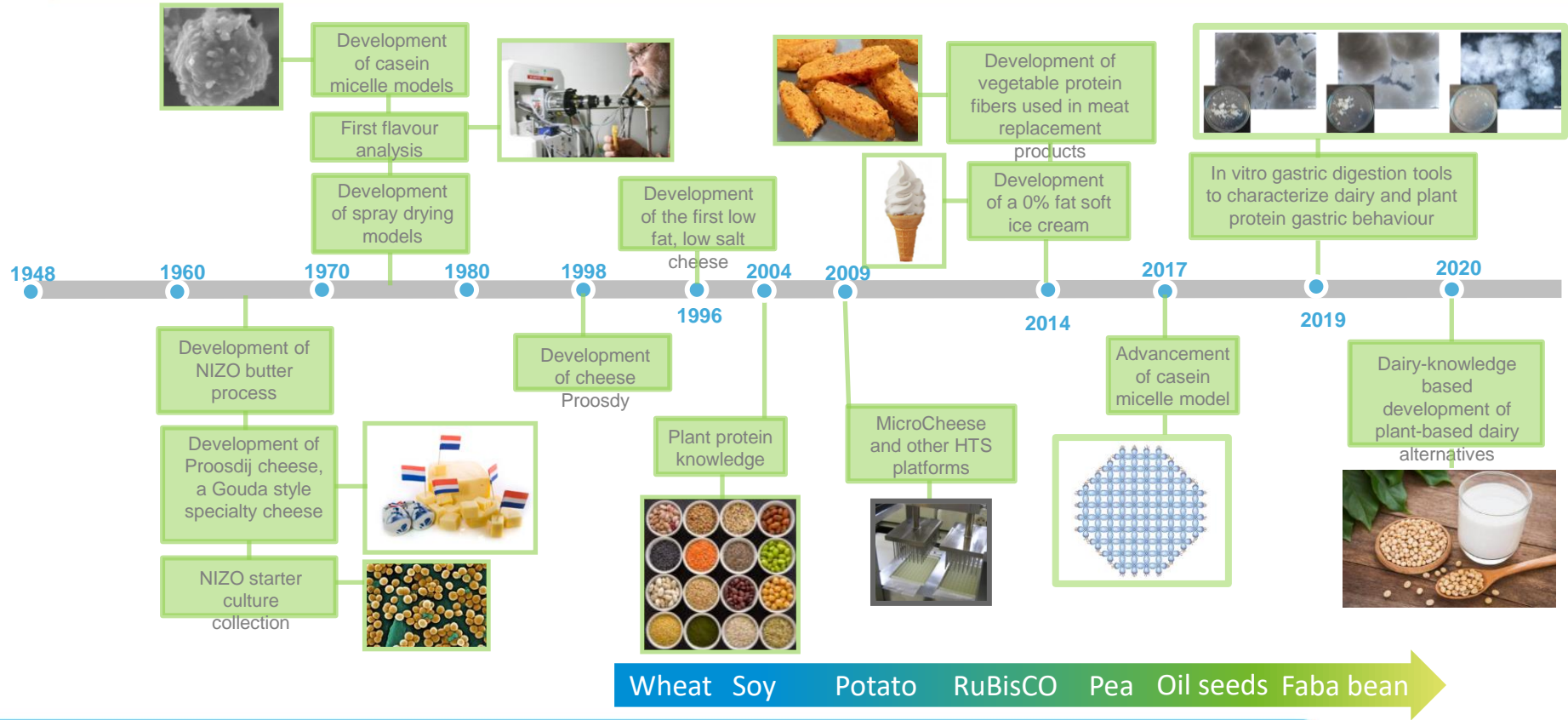
a stable tripod between Consumer, Technology & Landscape



- Independent, private contract research company for food and health
 - Proteins
 - Bacteria
 - Processing
- HQ in The Netherlands (Food Valley)
- 100+ professionals
- From lab to practice
 - Food-grade pilot plant

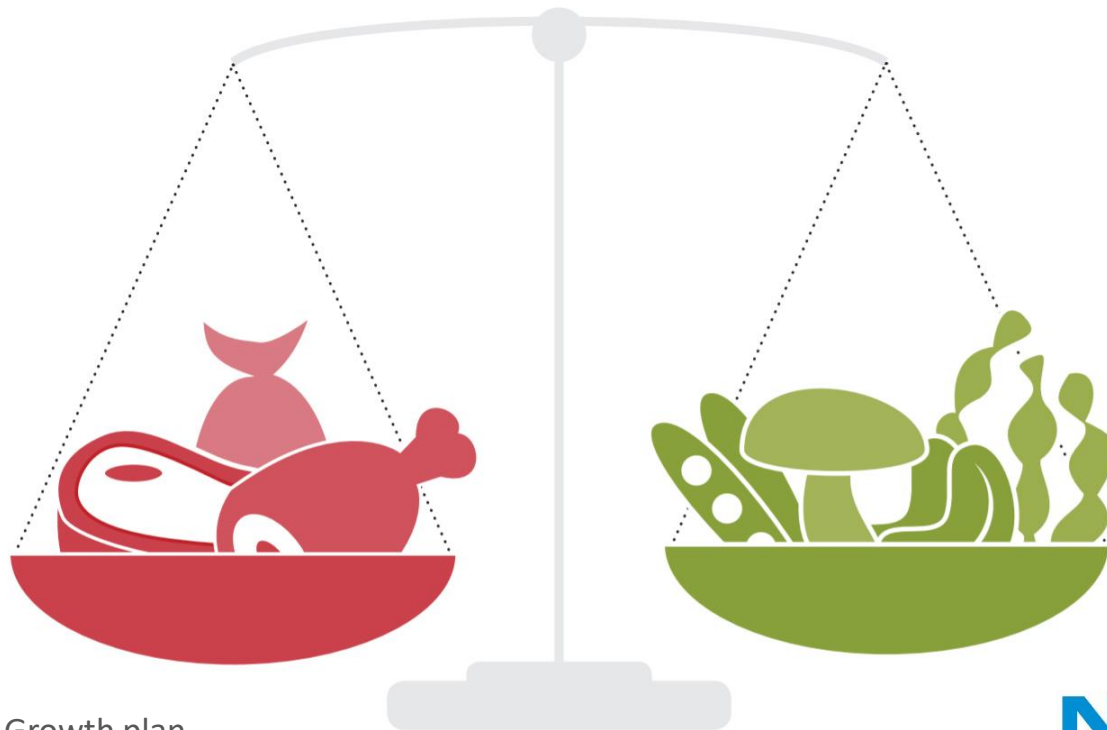


NIZO protein knowledge development



Healthy balance

50:50 target



Protein transition: current and future vegan protein sources

NIZO has hands on experience with these proteins

ESTABLISHED



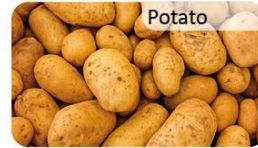
Soybean



Pea



Lupine



Potato



Rice



Corn



Faba bean



Chickpea



Lentils



Oat



Almond



Wheat

EMERGING



Sunflower



Mung bean



Rapeseed



Green leaves



Quinoa

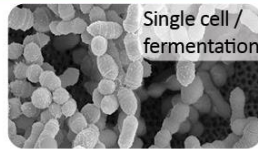


Microalgae

UP COMING



Nuts



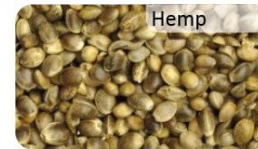
Single cell /
fermentation



Duckweed



Flaxseed



Hemp



Seaweed

How to select the best protein for plant-based food

so many choices

Consumers favourites



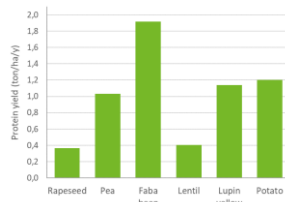
Farmers favourites



Potato



Wheat



Environmental favourites



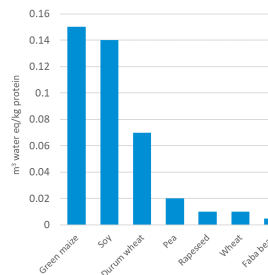
Faba bean



Pea



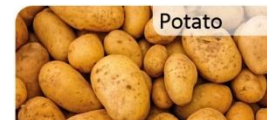
Rapeseed



NPD favourites



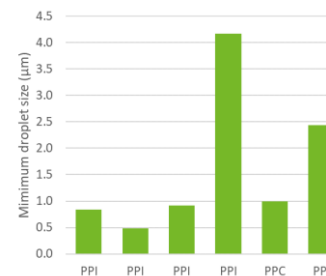
Soybean



Potato



Pea



Nutritionists favourites



Rice

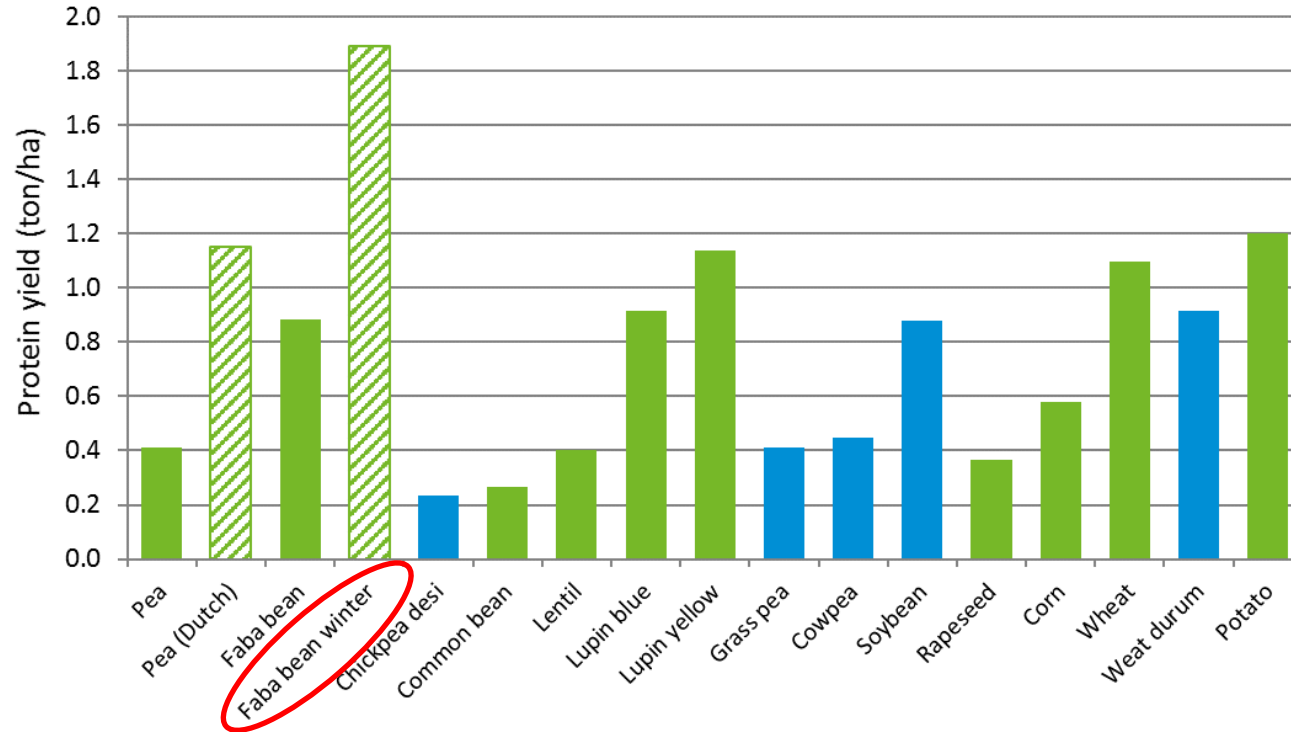


Pea



Protein yield of different crops

yield in ton protein/hectare

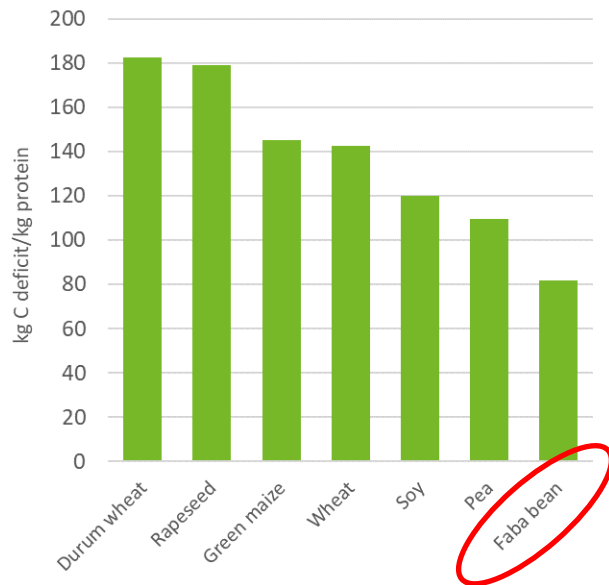


van de Velde (2016) *World Food Ingr.* (April/May) 44-47

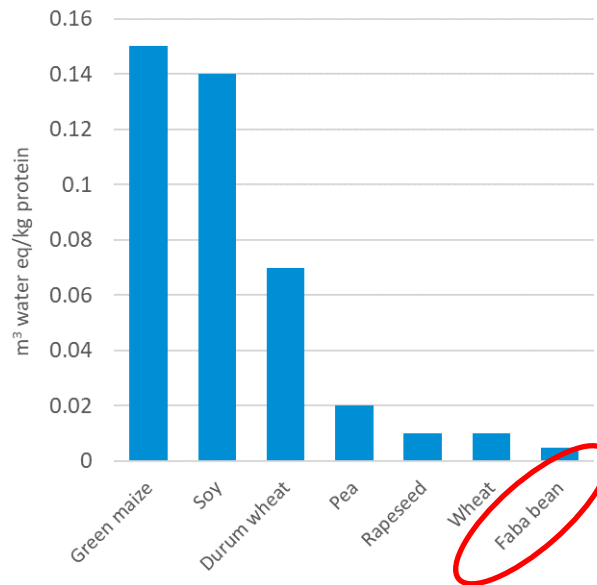
Agricultural impacts of faba beans

compared to different protein crops in France

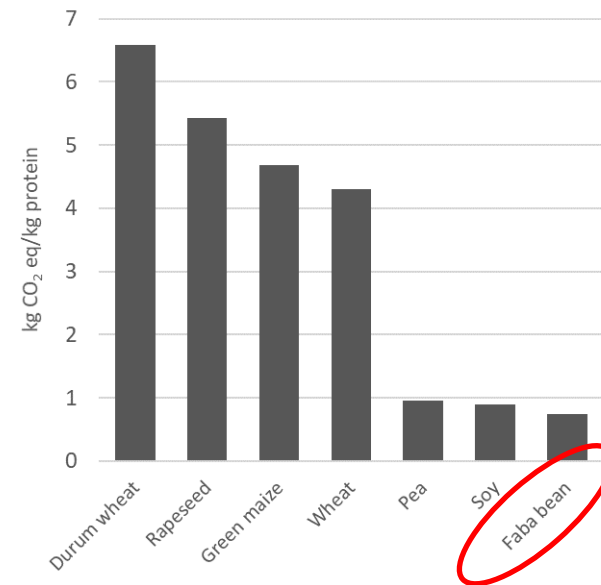
Land use



Water use



CO₂ emission



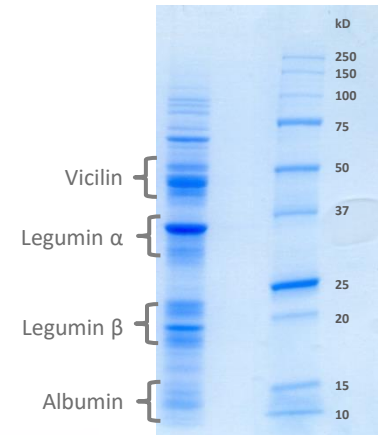
Faba bean scored the lowest values on all three climate parameters

Modified from Emmanuelle Moretti & Didier Videau (Roquette) Bridge2Food Protein Course 2018
Data from Agri-BALYSE, a public LCA database of French agricultural raw products

Faba bean proteins

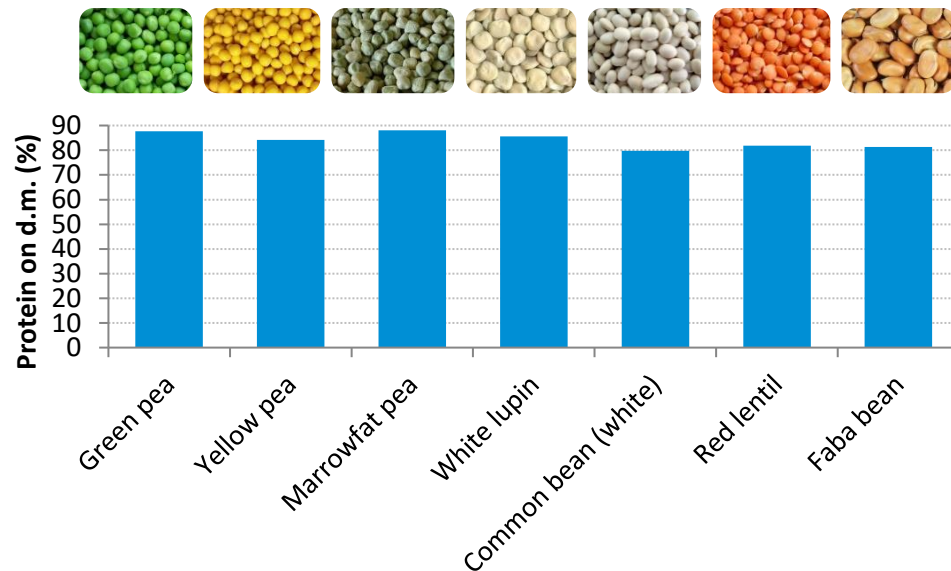
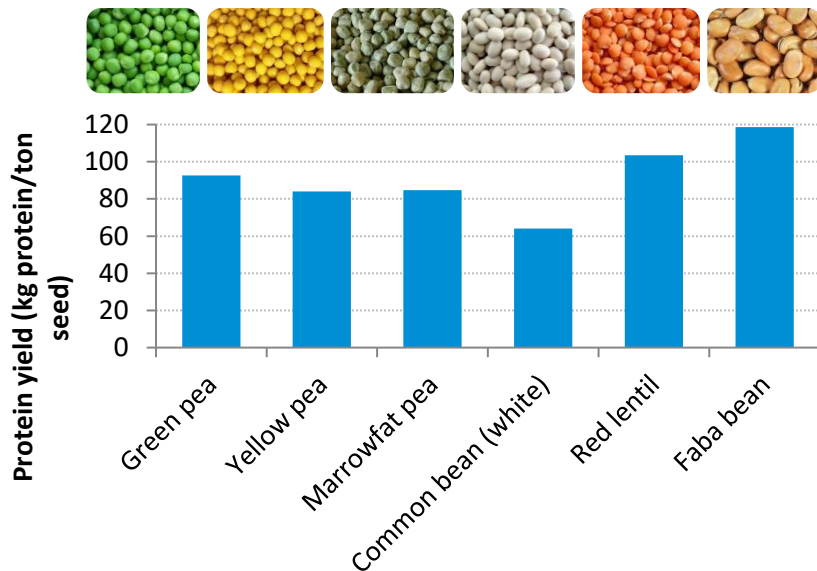
what are pulses?

- Pulses are edible seeds of the pods of legume plants
 - Fabaceae
 - Peas, faba beans, lentils and chickpeas
 - 20~30% w/w protein
 - Some oilseeds, such as lupin and soybean
 - >30% w/w protein
- Two main classes of water soluble proteins:
 - Albumins: anti-nutritional factor
 - Globulins: 65-70% of the protein
 - Legumin (11S)
 - Vicilin (7S)
 - Ratio Legumin:Vicilin affects functionality



Pulse proteins

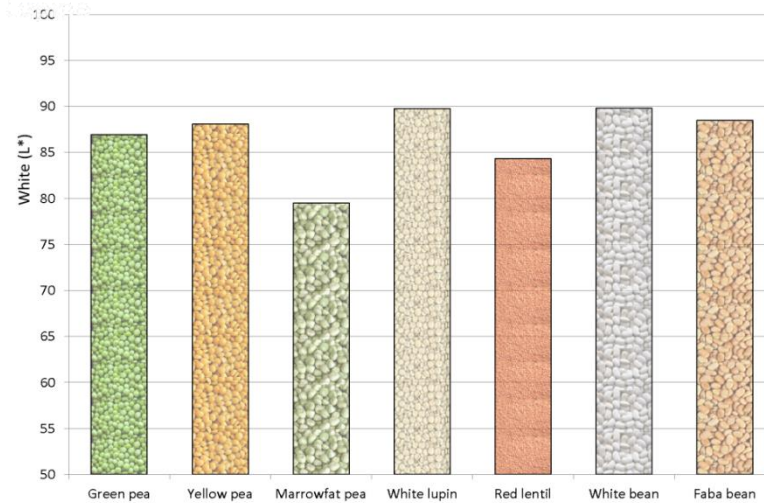
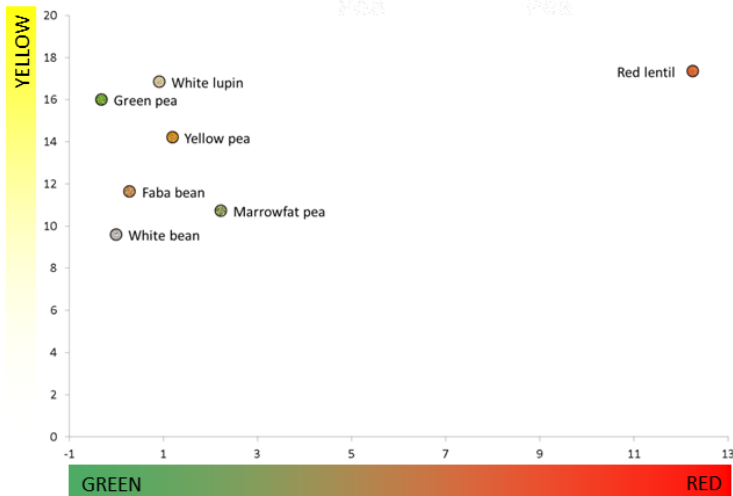
extraction yields



Highest protein extraction yield with faba bean
Protein purity > 80% w/w (using 5.7 as a nitrogen correction factor)

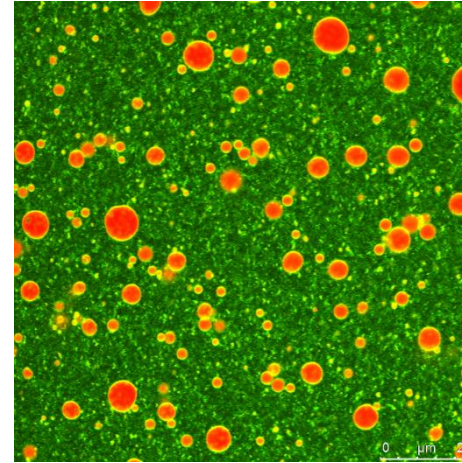
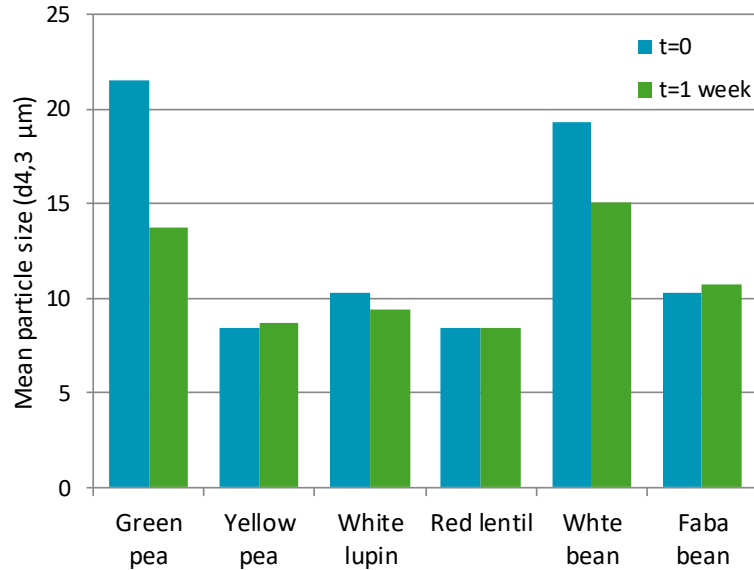
Pulse protein isolates

colour



Faba bean and pulse proteins

emulsification properties (20% oil)

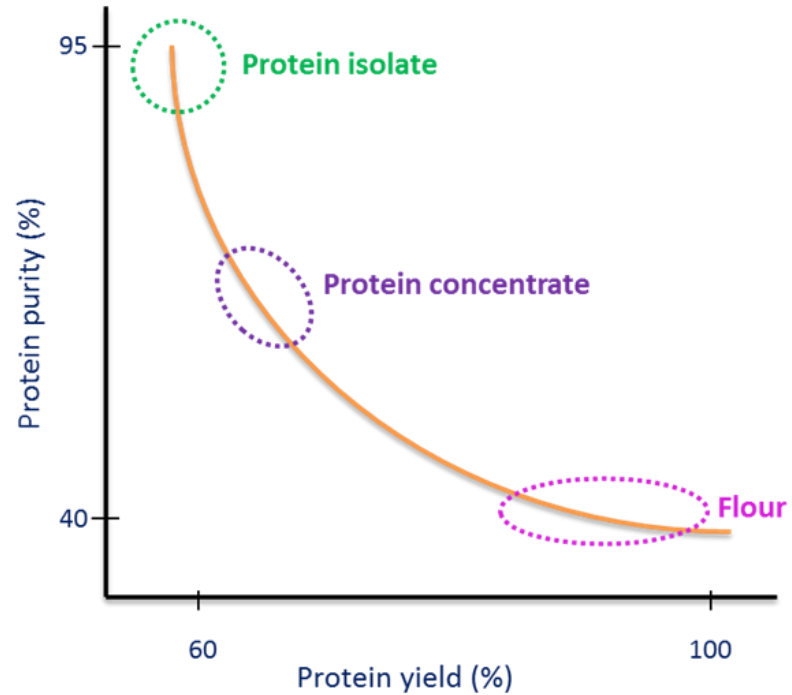


**Emulsifying properties of faba bean protein isolate
comparable to that of yellow pea protein isolate**

Protein source

how to select the right ingredient

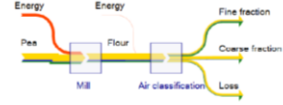
- Flour
 - Low in protein
- Concentrate
 - Sometimes native protein
- Isolate
 - Highly purified
 - High in protein



Fractionation of faba beans

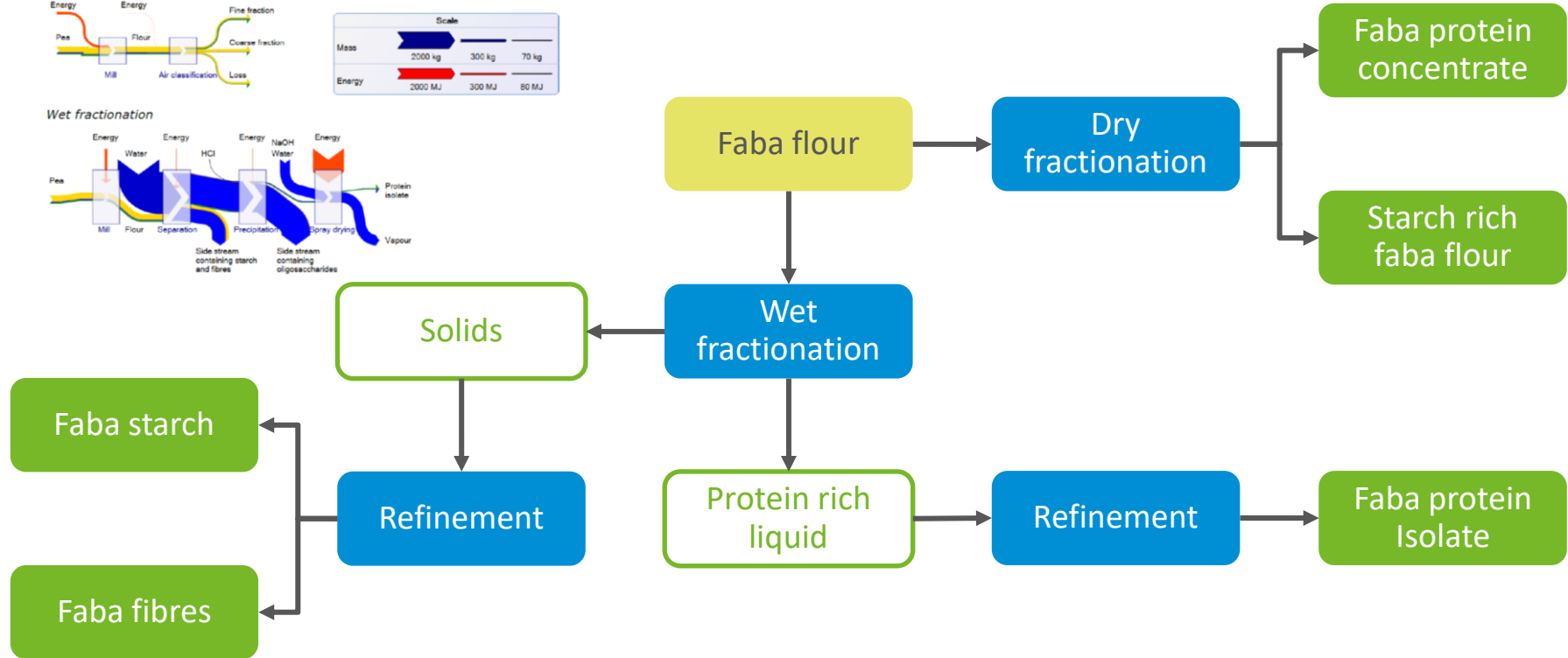
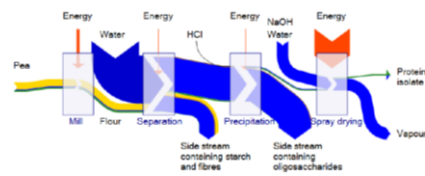
different ingredient from dry and wet fractionation

Dry fractionation



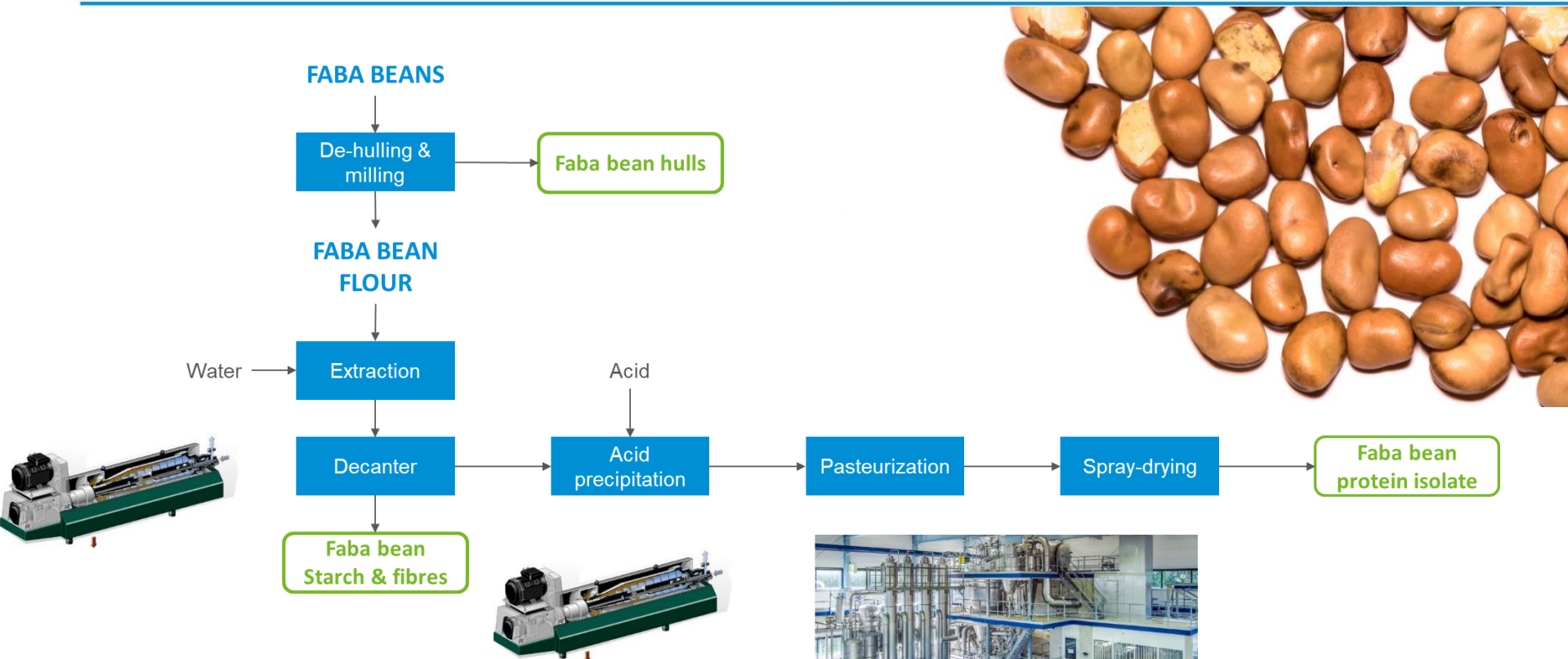
	Scale		
Mass	2000 kg	300 kg	70 kg
Energy	2000 MJ	300 MJ	80 MJ

Wet fractionation



Extraction process

faba bean proteins (and other starch seeds)



Different faba protein ingredients

average or typical composition (g/100g)

Ingredient	Protein	Starch	Fibre	Fat
Faba bean flour	28-33	30	21	2
Faba protein concentrate <i>(dry fractionation)</i>	60-70	<5	<3	<5
Faba protein isolate <i>(wet fractionation)</i>	80-90	-	<1	<5
Textured faba bean	60		11	

PULSE project

from seed to food

Breeding

SEED

Agriculture

CROP

Harvest

SEEDS

Extraction

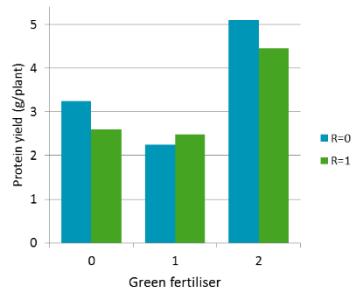
PROTEIN

Process

FOOD



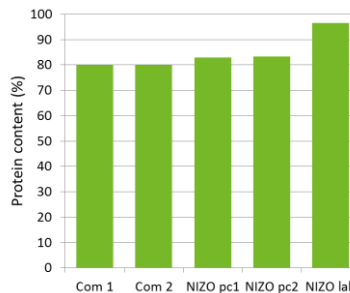
Breeding your profit



From seed to food. Naturally



RUITENBERG
INNOVATION AS MAIN INGREDIENT



Protein Utilisation from Legumes for a Sustainable European crop Legumes as a source of dietary protein in a sustainable food chain (PULSE)

Mail
Share

Details

Project number
RAAK-PROG.051

NIZO
FOR BETTER FOOD & HEALTH

has
hogeschool

PULSE project

a multi-disciplinary project

Breeding

SEED

Agriculture

CROP

Harvest

SEEDS

Extraction

PROTEIN

Process

FOOD

Applied
Biology



Toegepaste
Biologie

Agriculture



Tuin- en
Akkerbouw

Environmental
Technology



Milieukunde

Food
Technology



Voedingsmiddelen-
technologie

Food
Innovation



Food Innovation

Faba bean protein isolate

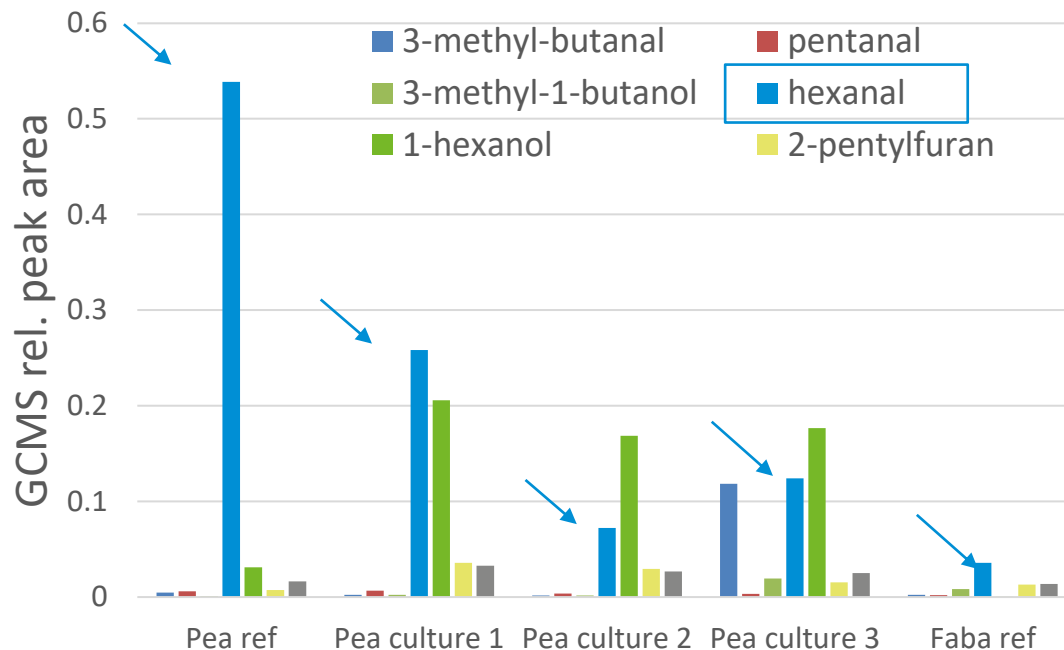
pilot scale processing and application

- Process improvement on the processing of faba bean
 - Faba bean protein isolate
 - 88% protein on dm
 - Highly functional
- Development of vegan ice cream



Volatile off-flavour compounds can be altered during fermentation

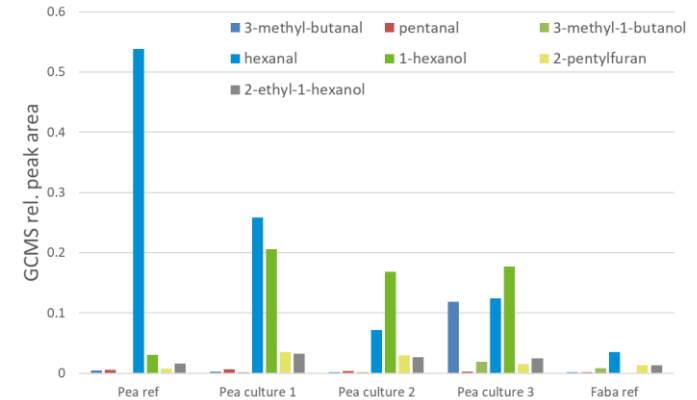
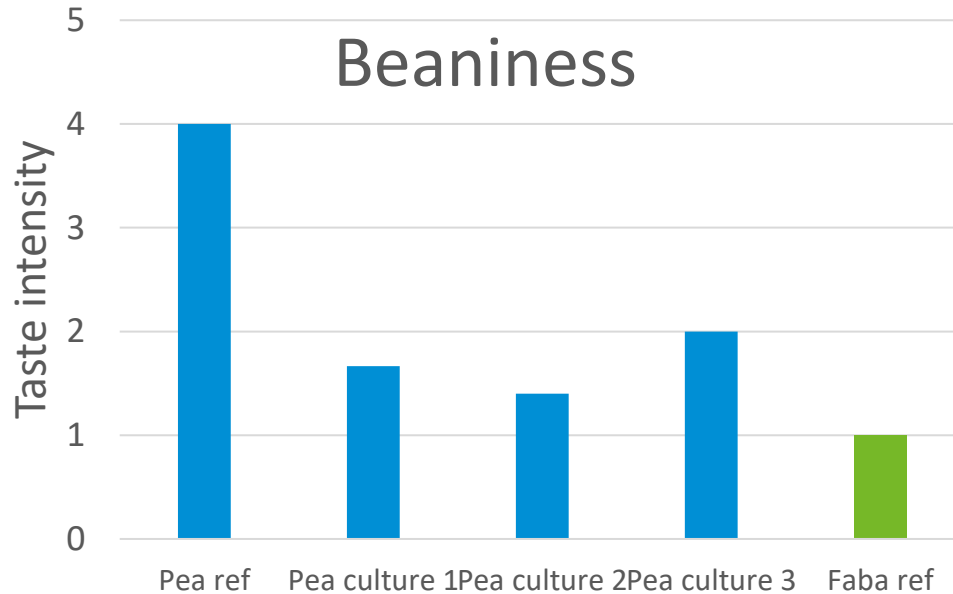
Reduction of hexanal



Source: NIZO strategic research on fermented, plant-based dairy alternatives

Fermentation decreases Off-flavour of protein isolate

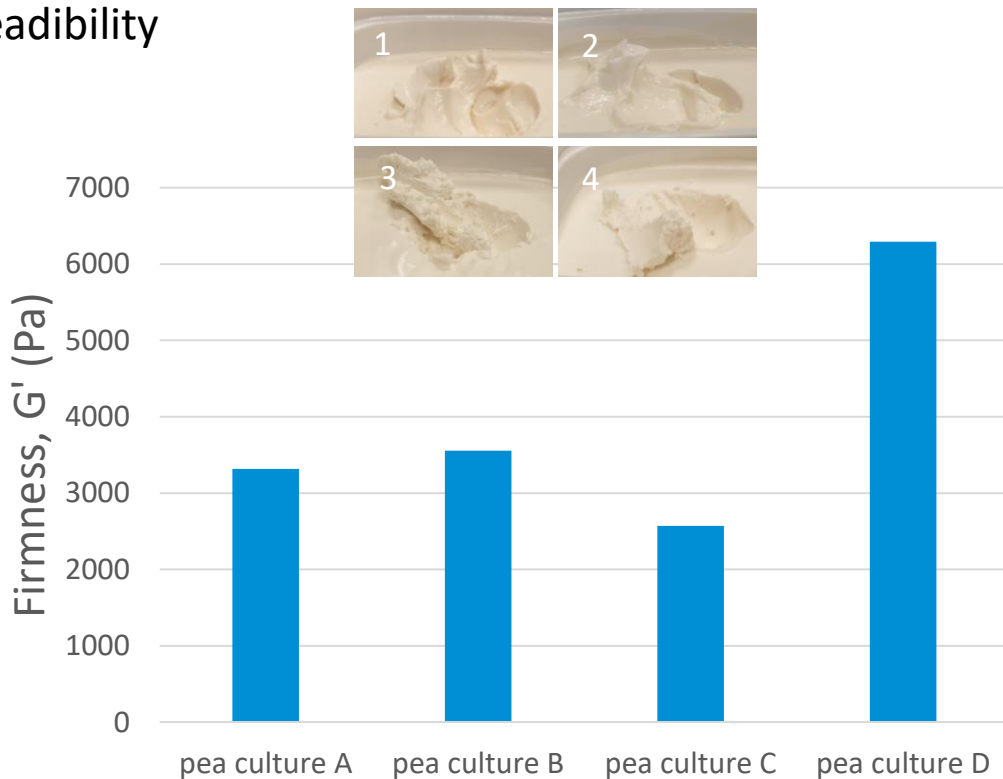
Reduction of beaniness corresponds to reduction of hexanal



Source: NIZO strategic research on fermented, plant-based dairy alternatives

Structure can be altered by different cultures

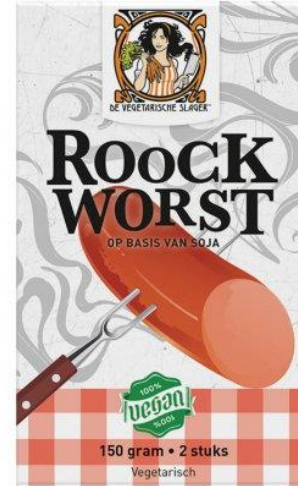
- Texture: firmness, smoothness, spreadability
 - Texture measurement



Source: NIZO strategic research on fermented, plant-based dairy alternatives

Faba bean protein

examples of applications



Faba beans

from seed to food

Breeding

SEED

Agriculture

CROP

Harvest

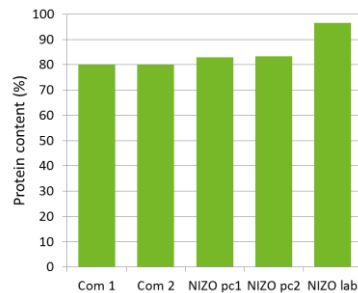
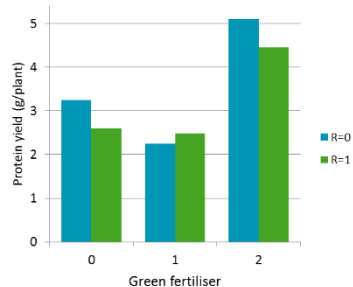
SEEDS

Extraction

PROTEIN

Process

FOOD



Protein Utilisation from Legumes for a Sustainable European crop Legumes as a source of dietary protein in a sustainable food chain (PULSE)

Mail
Share

Details

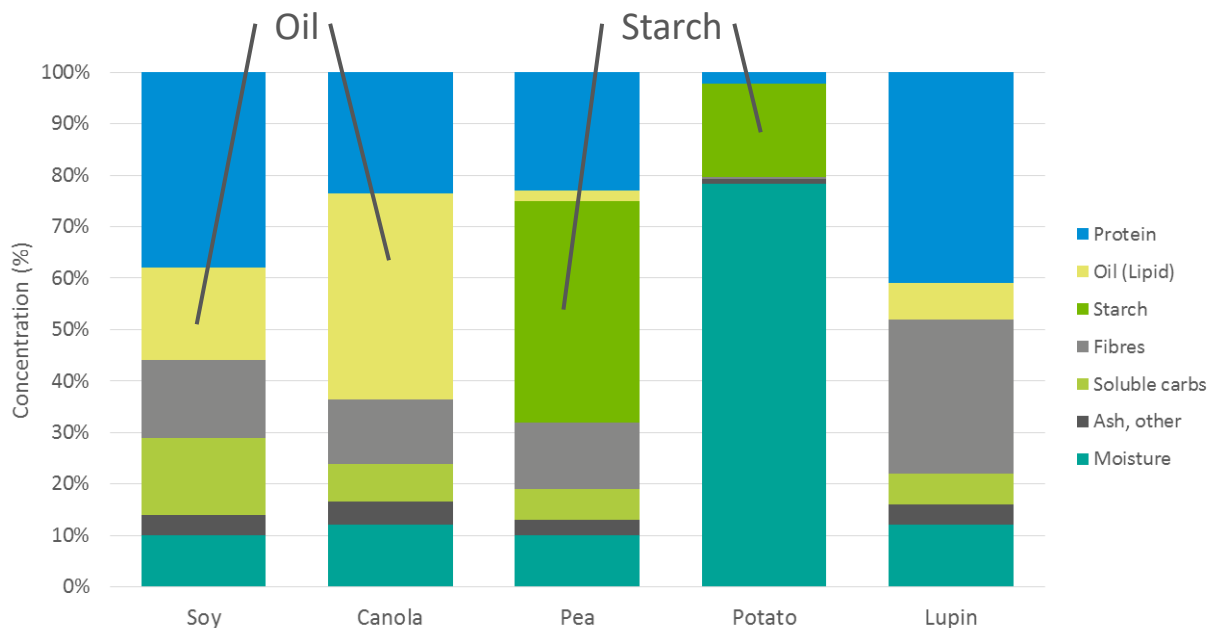
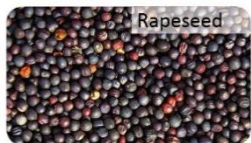
Project number
RAAK_PR002_051

NIZO
FOR BETTER FOOD & HEALTH

has
hogeschool

Plant proteins

economic drivers



Oil and starch are important for the economic feasibility
This will also hold for faba bean protein

2nd NIZO Plant Protein Functionality Conference

Papendal, The Netherlands • 11–14 October 2022



- Plant and single cell protein ingredient manufacture
- Process-product interactions affecting plant protein functionality
- Protein structure, stability and interactions within food products
- Fermentation to improve the quality of plant protein ingredients and products
- Influence of plant protein ingredients in food product structure and stability
- Nutrition and digestion of plant proteins in human food
- Sustainability along the chain of plant protein ingredients and application in foods



Bedankt voor uw aandacht!

