Intrinsic – Integrated sustainable processing of oil and functional protein from oilseeds

5-year project (start: 2022), both fundamental and applied research

6-6-2024, Peter Geerdink, Wim Mulder, Aard de Jong

WAGENINGEN
UNIVERSITY & RESEARCH

Project partners

- **Foss**: Developer of analytical equipment. Creates end-to-end solutions that secure and improve food quality (Denmark)
- **Cano-Ela**: Startup developing a novel, solvent free process to extract less refined ingredients from oilseeds (Netherlands)
- **Riverina**: Vertically integrated, bulk canola oil supplier, located in NSW, Riverina region (Australia)
- **Valtris/Champlor**: Processer of rapeseed from regional sources (France)
- **Danone**: Global company in dairy and plant-based products, early life and medical nutrition and waters (Netherlands)
- **Wageningen UR**: University and research institute in the field of agriculture and life sciences (Netherlands)
- **Project sponsored by the Dutch government (TKI financing)**

FOSS

Cano-ela
Unlocking the potential of seeds

RIVERINA OILS

VALTRIS
SPECIALTY CHEMICALS

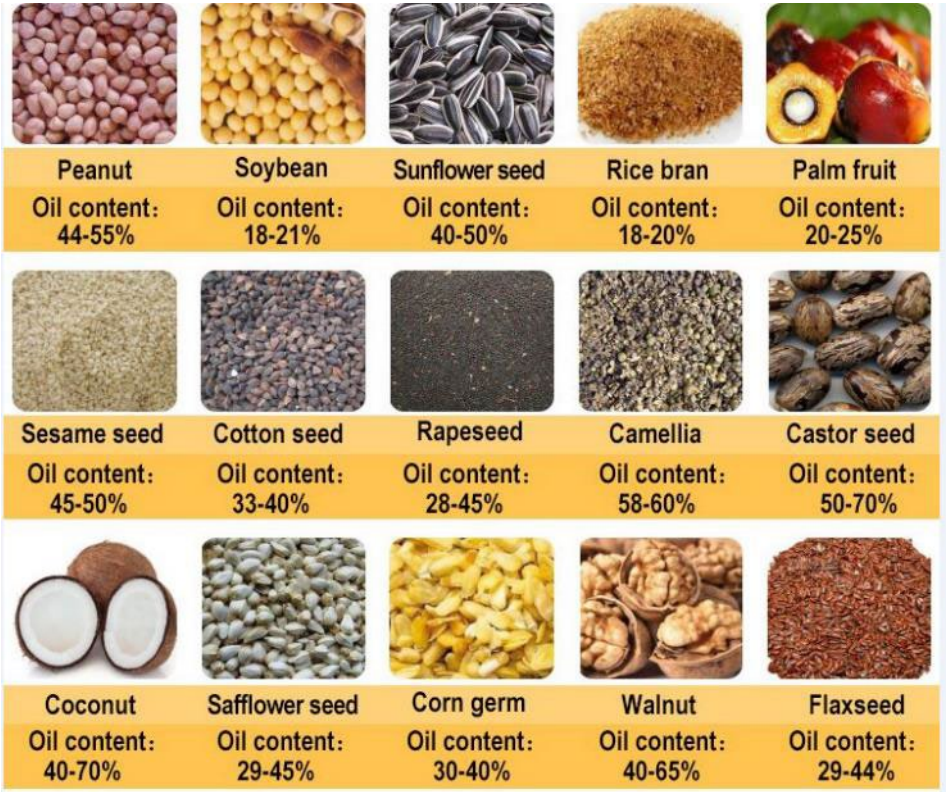
DANONE
ONE PLANET. ONE HEALTH

WAGENINGEN
UNIVERSITY & RESEARCH

WAGENINGEN
UNIVERSITY & RESEARCH

Traditional oilseeds and other oil crops

- Processing differs per crop
- Most seed processing similar
  - Expeller
  - Solvent extraction
- Extracted meal mostly feed
- Recently more interest in proteins from oilseed meal



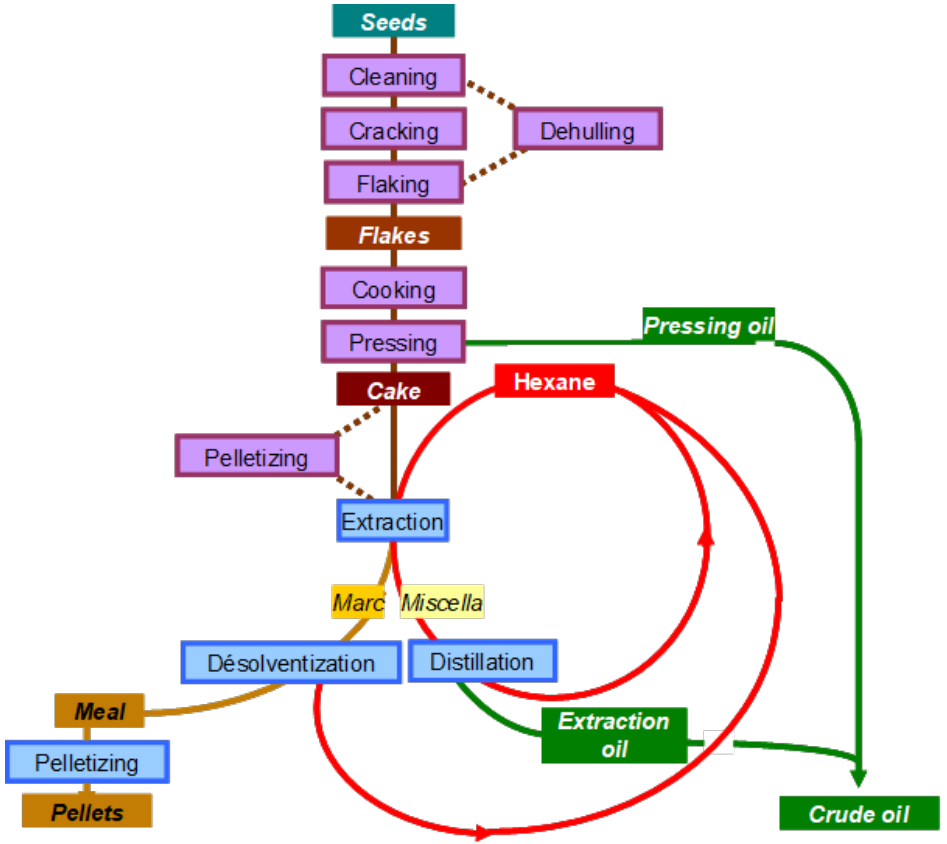
WAGENINGEN
UNIVERSITY & RESEARCH

Oilseed of choice

- Oilseeds of choice:
  - Rapeseed/Canola
    - Mostly produced in EU, Canada and Australia
  - Sunflower
    - Mostly produced in EU, Ukraine and Russia
- Oilseeds are an important crop for the transition from mineral oil to a sustainable alternative

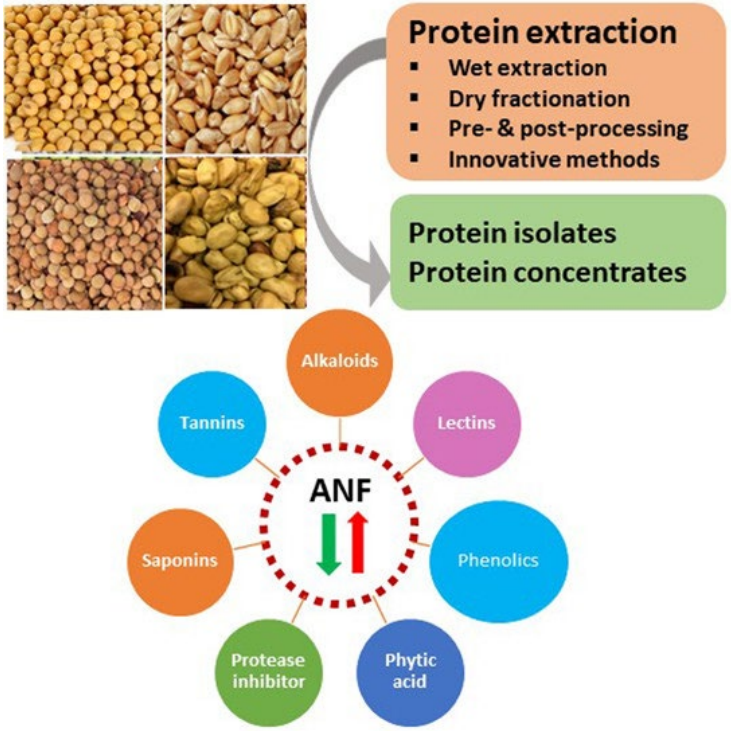
Oil production from oilseeds – traditional

- Processing steps – oilseeds
  - Sorting/cleaning
  - Dehulling
  - Grinding/milling
  - Conditioning/flaking
  - Cooking/expanding
  - Pressing
  - Solvent extraction
  - Toasting/desolventising
  - Oil distillation & refining



Background

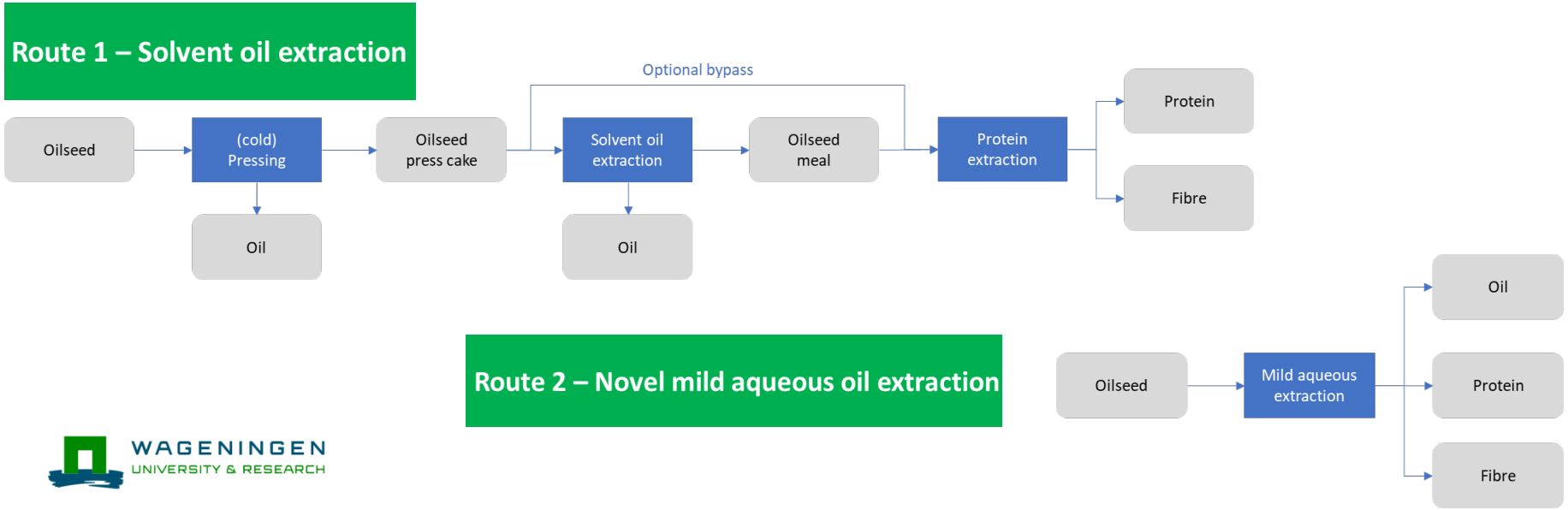
- Oilseed residues are the largest global source of protein, mostly used as feed.
- Protein from oilseed has a huge potential impact as a food ingredient.
- Challenges:
    - Extractability of protein after oil extraction
    - ANF's and residues in the protein product
    - Optimization of protein yield combined with oil yield



Amin *et al*, 2022

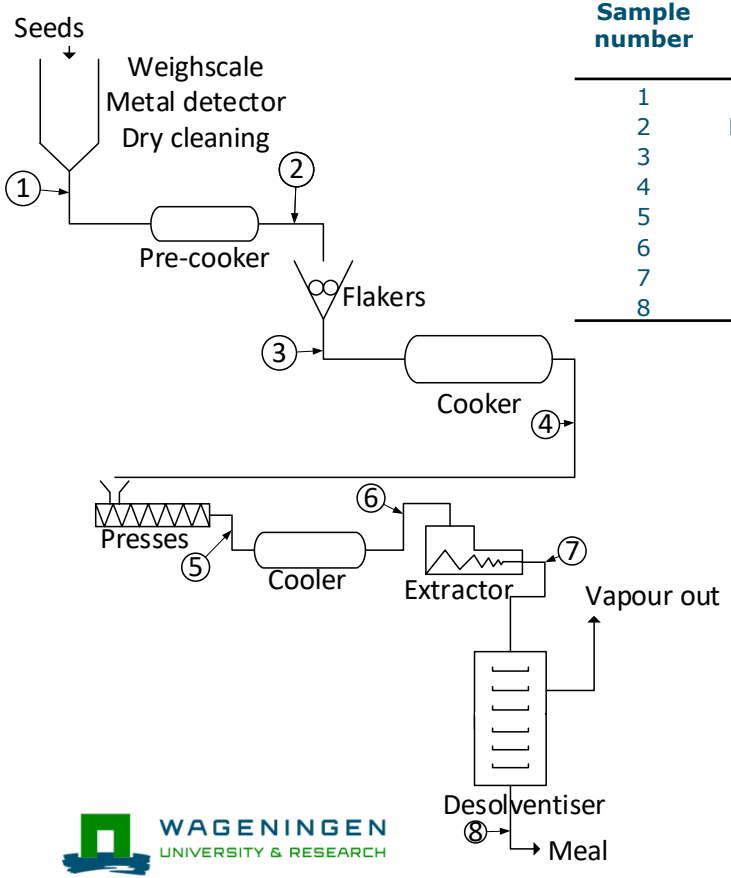
Objective

- Develop 2 routes for protein and oil production from rapeseed
  - Protein extraction of material from a conventional oil production plant
  - Protein and oil production via novel aqueous protein and oil production route



WAGENINGEN
UNIVERSITY & RESEARCH

Industrial processing and in-factory sampling



Sample number	Name	Dry weight (%)	Protein content (%)
1	Inlet	93.1	18.6
2	Pre-cooker	94.1	18.2
3	Flaking	94.3	17.7
4	Cooker	96.0	18.6
5	Press	92.9	26.5
6	Cooling	95.3	26.6
7	Extractor	90.7	33.8
8	Toasting	90.1	34.0

Site: Valtris/Champlor, Verdun, France

WAGENINGEN
UNIVERSITY & RESEARCH

Process-product interaction

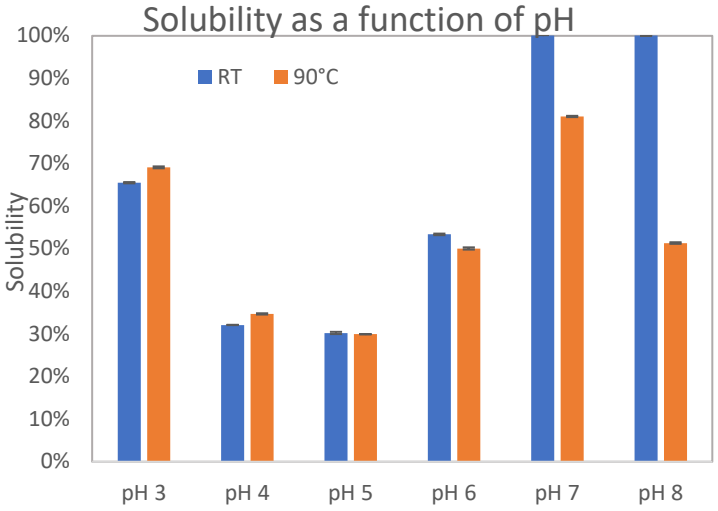
- Protein solubility influenced by industrial processing

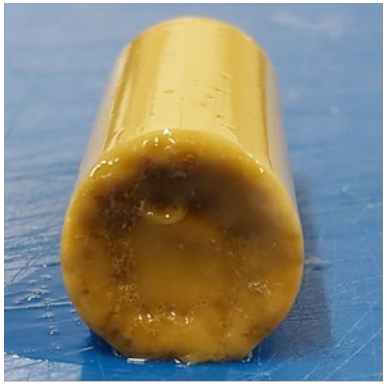
= samples analyzed at varying pH

Sample 7 starting material for extraction

Results

- Small scale napin extraction
    - 82% protein purity, napin yield 50%
- Functional properties:





pH 8
Self-supporting gel

Future research

- Scaling up napin isolation.
- Simultaneous extraction of cruciferin
- The removal of anti-nutritionals in the process will be assessed
- NIR methodology (FOSS) will be developed to analyse properties in the samples.
    - Create a predictive method to provide insight in protein properties

WAGENINGEN
UNIVERSITY & RESEARCH

Sunflower

Scaling up?

- **Rapeseed**
  - Cruciferin (11S globulin)
  - Napin (2S albumin)
  - Oleosin

- **Sunflower**
  - Helianthinin (11S globulin)
  - Albumin (2S albumin)
  - Oleosin

Cruciferin has 40% homology with Helianthinin
Napin has 23% homology with 2S albumin form sunflower

Thank you for your attention

Project team:

- Brigit Beelen
- Costas Nikiforidis
- Sybren Zondervan
- Nam-Phuong Hublet Hua
- Marieke Schenkel
- Willemijn Liese

WAGENINGEN
UNIVERSITY & RESEARCH