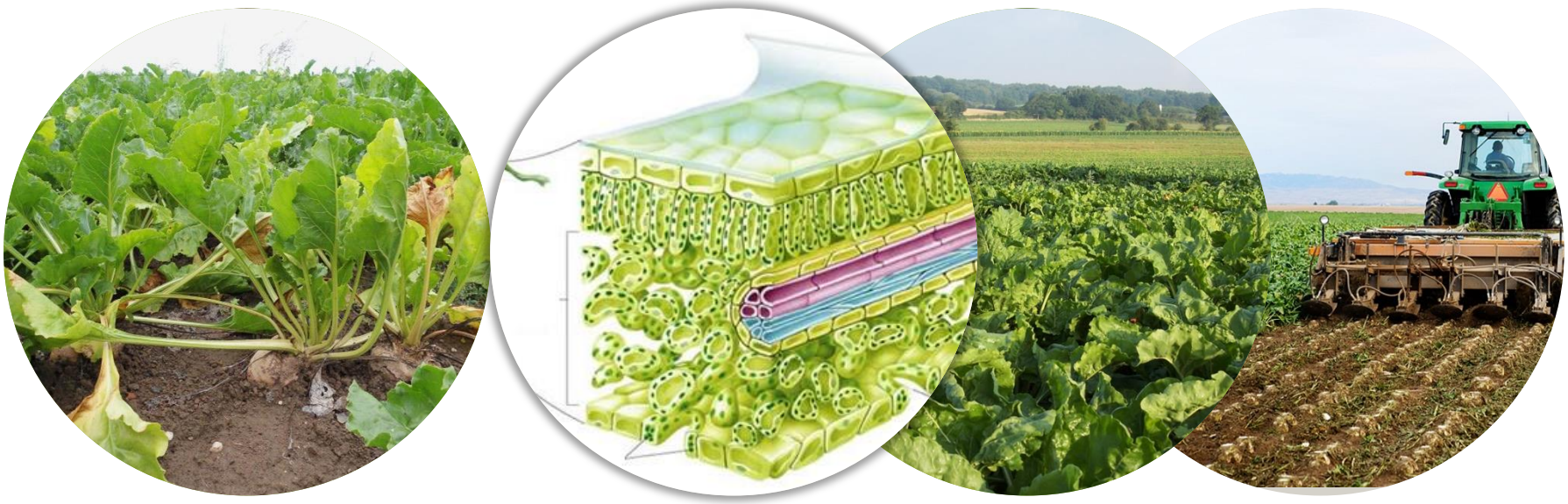
GreenProteins

Isolation of hydrophobic proteins from green plant materials

Angélica Tamayo Tenorio

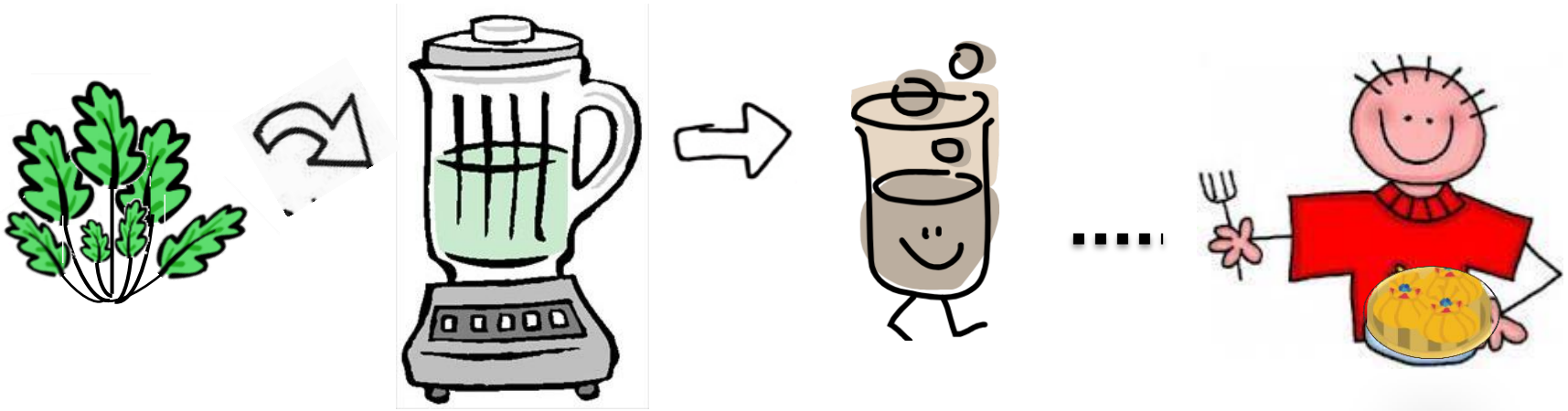


September 18th, 2014

Overview

- Introduction – project background
- Analysis during the harvesting time
  - Results and conclusions (2013)
- Approach: valorise SBL
  - Current work
  - Future planning

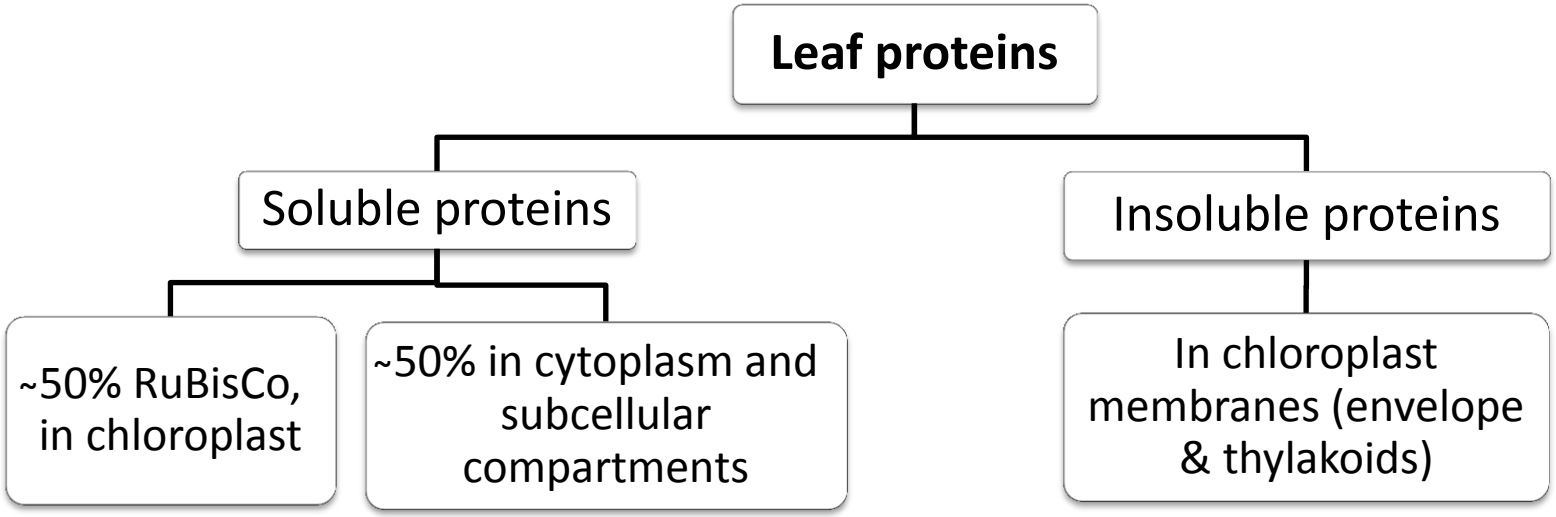
Sugar-beet leaves as a protein source



Objective:

- Mild extraction and isolation of the hydrophobic **membrane bound proteins** from sugar beet leaves
- The protein-rich extract for **food applications**.

Leaf proteins



- Rubisco extraction
- White leaf protein concentrate
- Functionality and food applications

- Extraction for proteomics
- Neglected in protein extraction
- Potential applications in clinical food, green colour

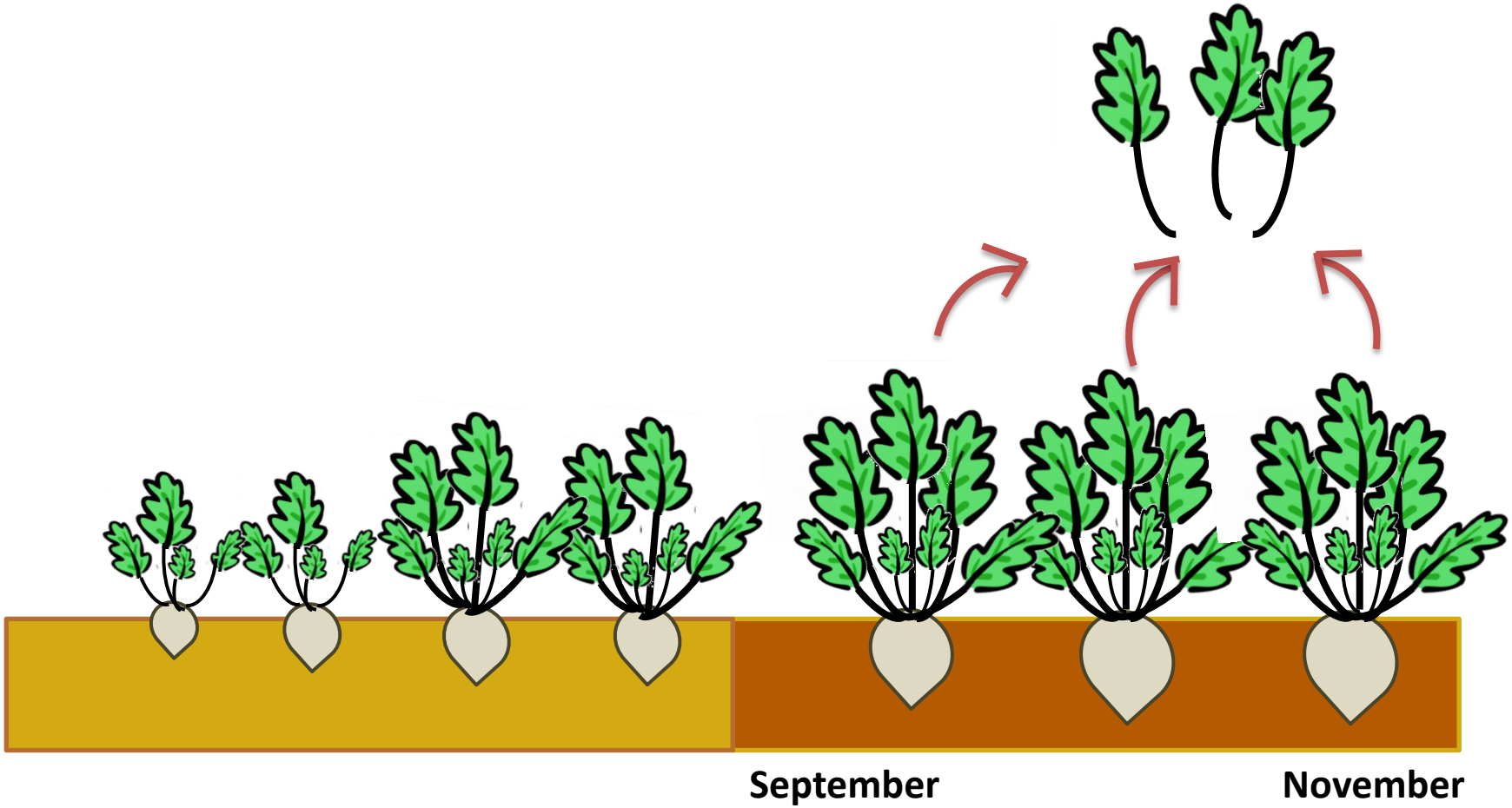
Plant material as protein source

- Valorisation of by-products
- Waste material available
- Potential for protein extraction (spinach, alfalfa, tobacco), a.a. profile
- High water content

Sugar beet leaves

- Large amounts available
- Seasonal
- Stabilization to work off-season
- Cooperative work

Analysis during the harvesting time



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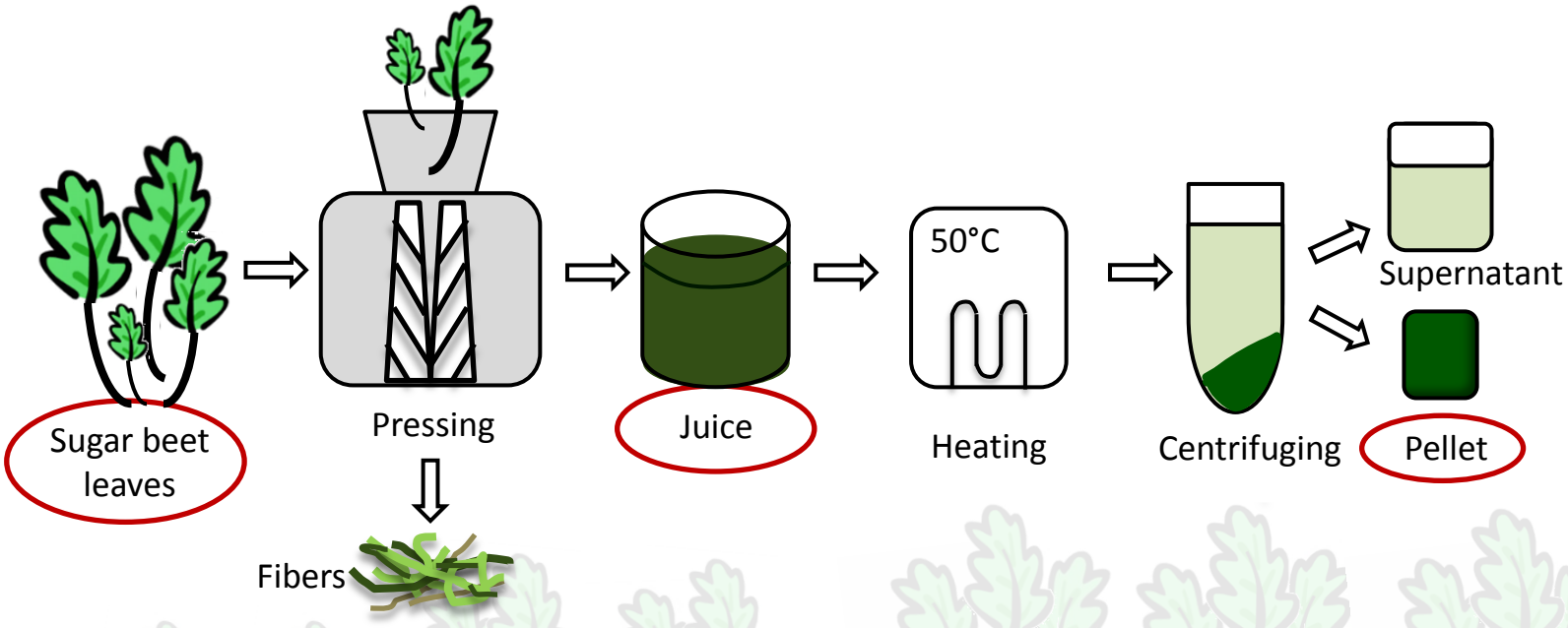
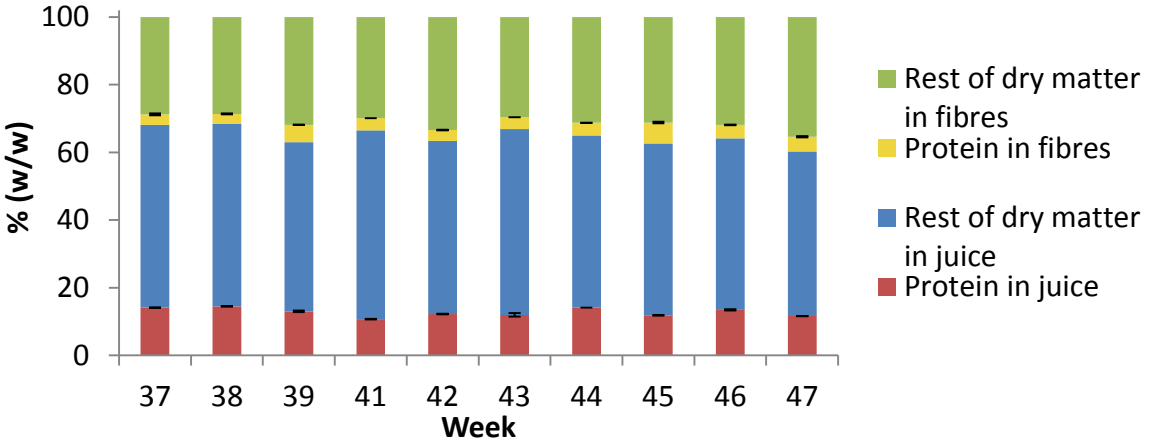


Freezing material at -25°C
Characterisation of juice and “green pellet”
Mass and protein balance

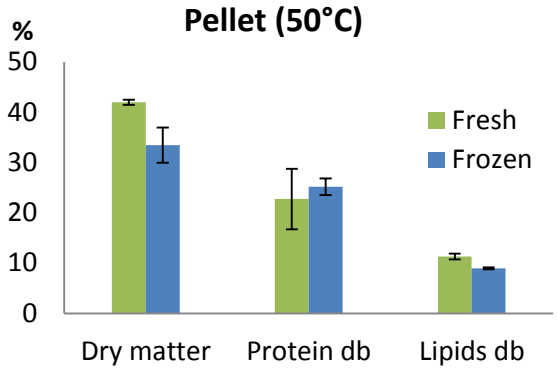
September November

Juice characterisation – harvest time

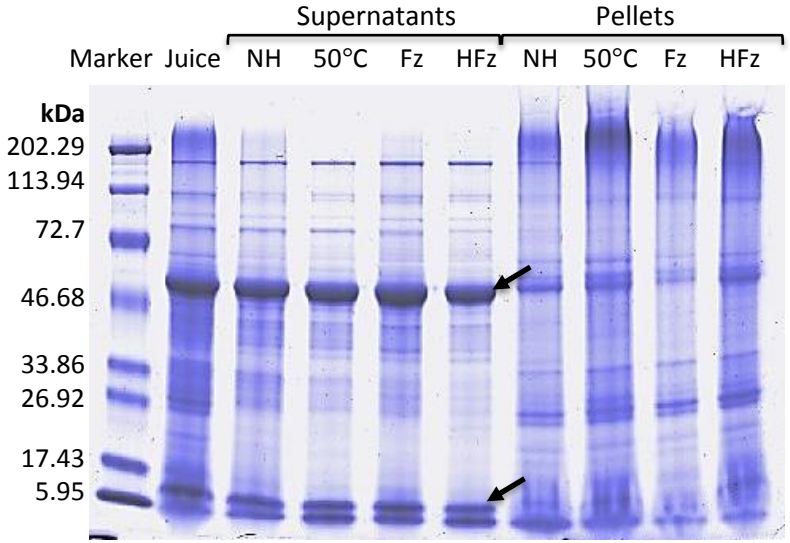
Protein distribution on dry mater



Leaves: fresh vs. frozen



Molecular characterisation SDS-page



Juice characterisation – harvest time

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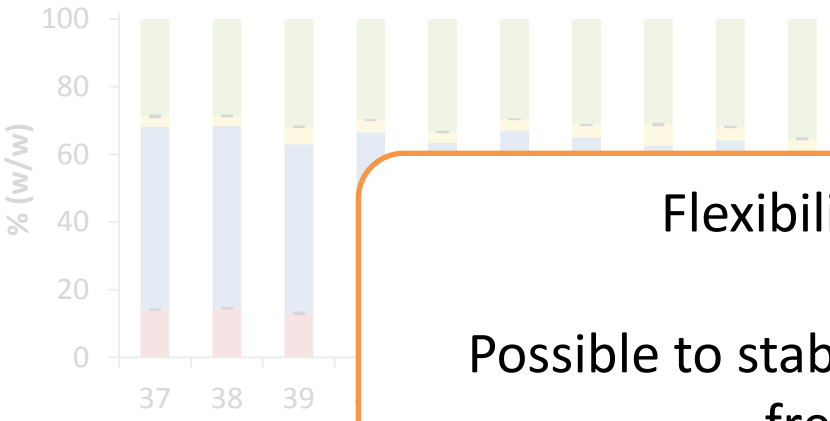

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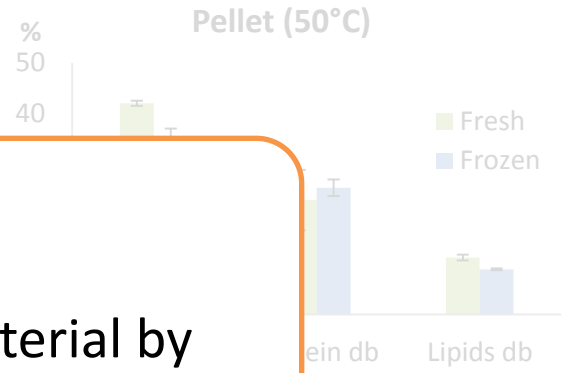
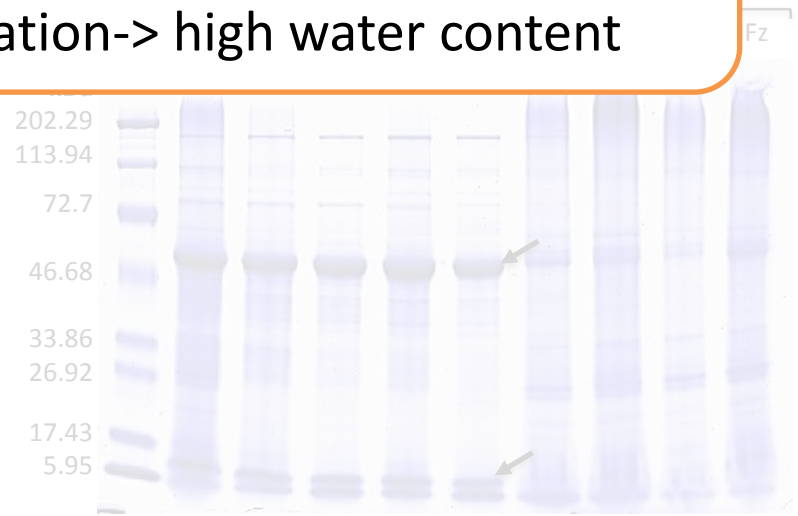


Flexibility to harvest SBL

Possible to stabilize different material by freezing (-25°C)

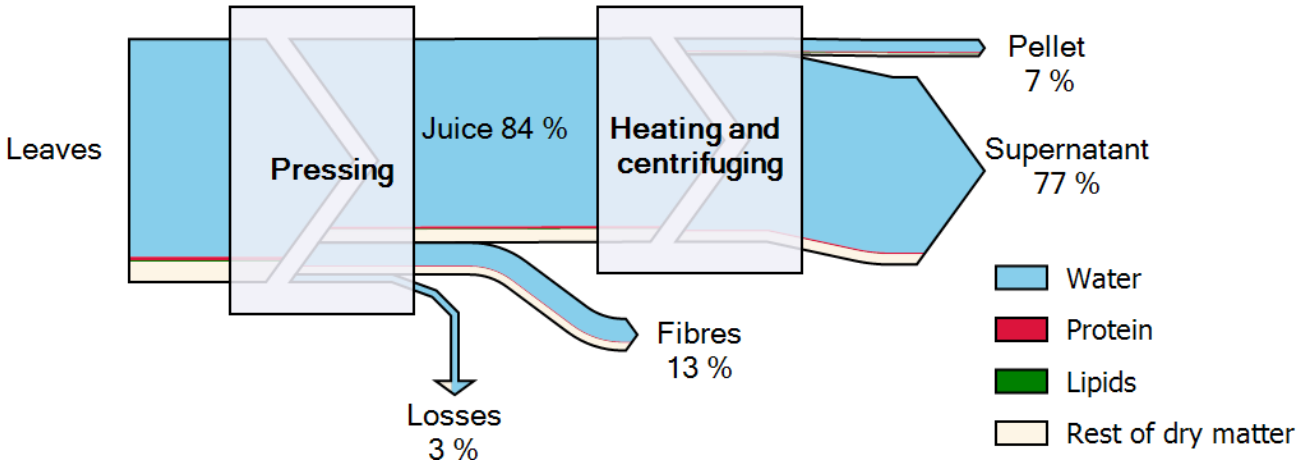
Quick stabilisation-> high water content

Molecular characterisation
SDS-page

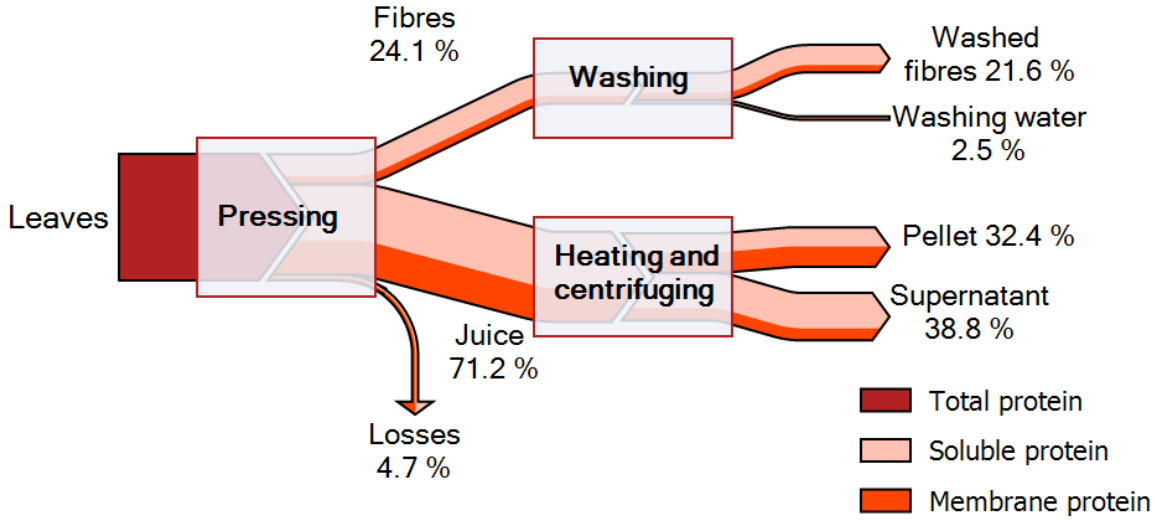


Leaves or water?

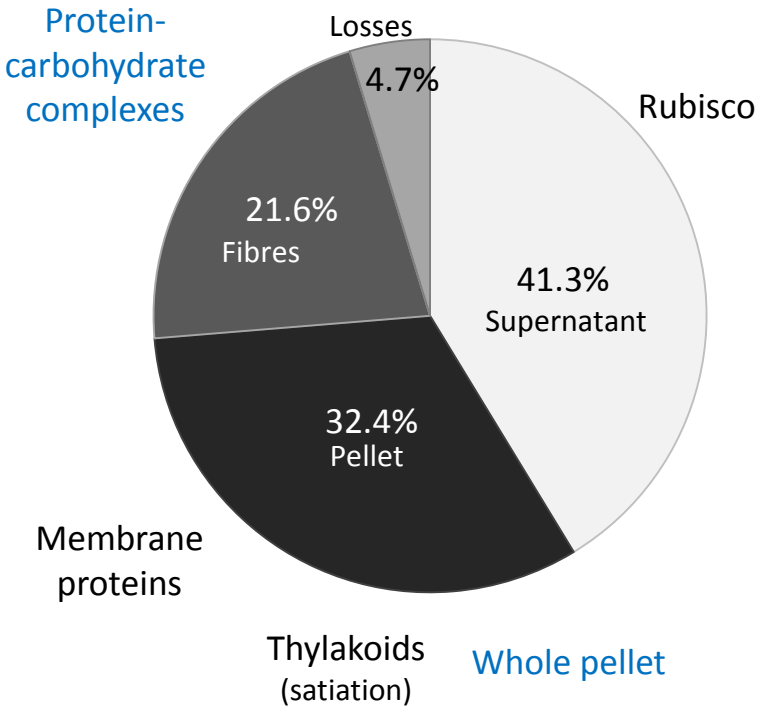
Mass balance

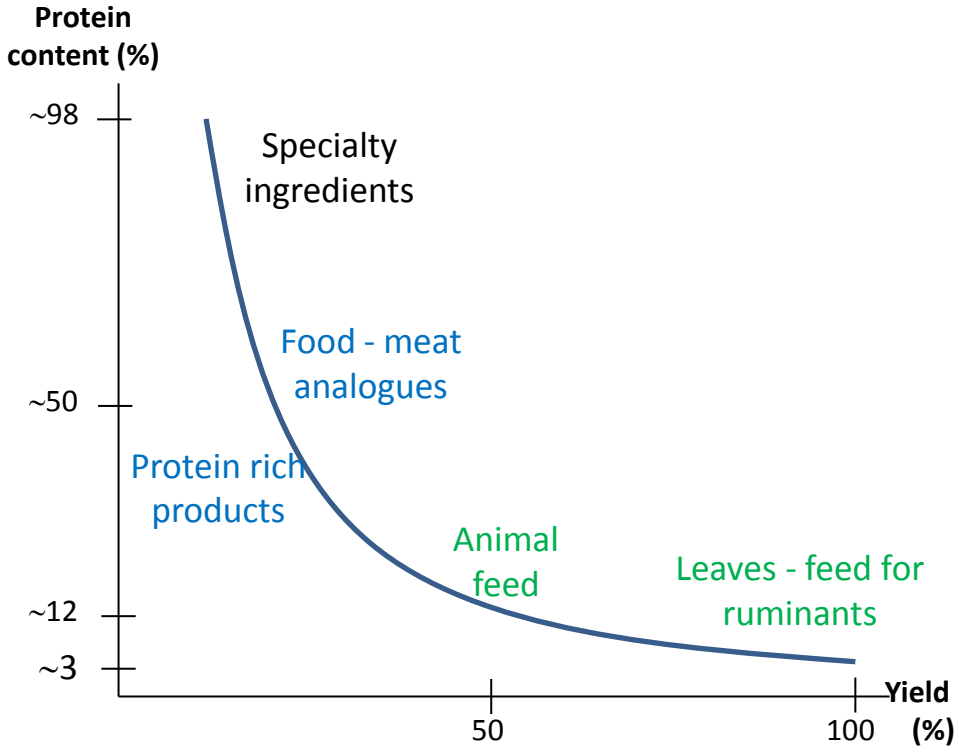


Protein distribution during processing



Approach – valorising SBL proteins





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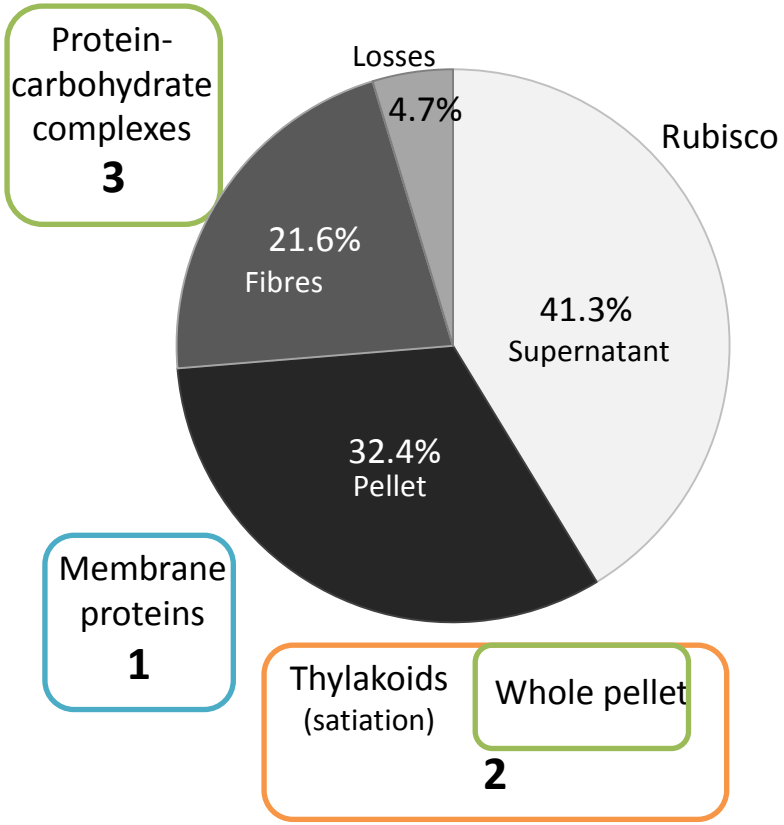


1. Purification and characterisation of membrane proteins

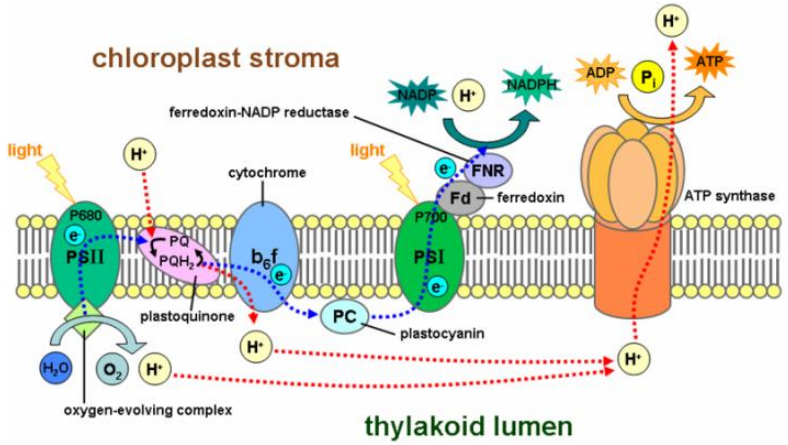
2. Functional properties of thylakoids and less purified membrane proteins

3. Aqueous extraction of SBL fibres and whole membrane protein fraction - applications

1. Purification and characterisation of membrane proteins

1. Proteomics approach

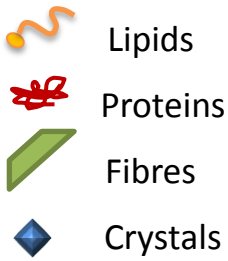
Pressing leaves → Acetone Acetone-TCA Methanol ↔ Heat or pH treatment ↔ Surfactants/ removal

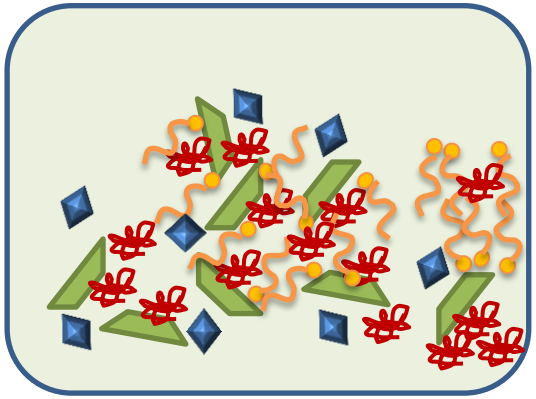


http://en.wikipedia.org/wiki/File:Thylakoid_membrane.png

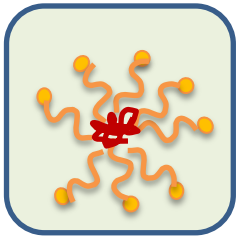
1. Proteomics approach

Understanding the membrane protein fraction

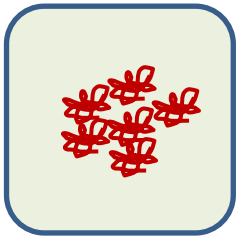




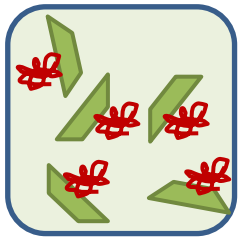
Sophisticated biomolecular structures



Micelles



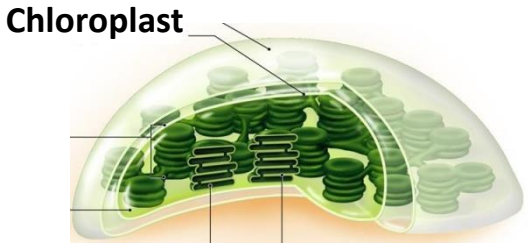
Aggregates



Carbohydrate-protein complexes

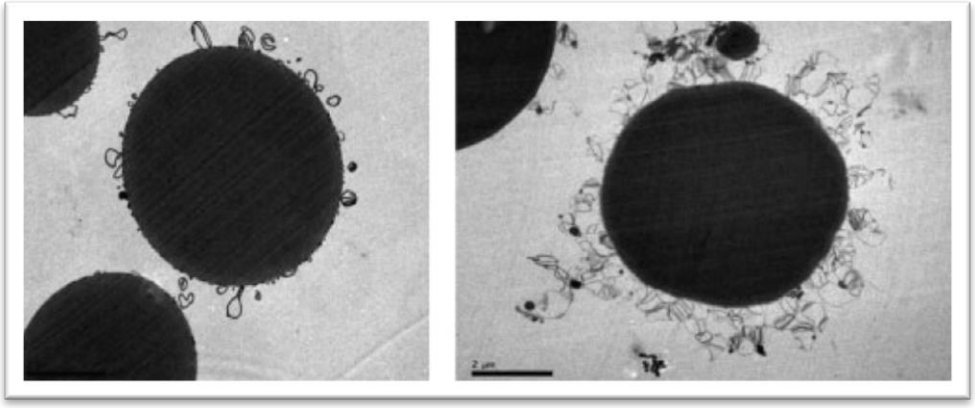
2. Functional properties of thylakoids and less purified membrane proteins

SBL thylakoids:



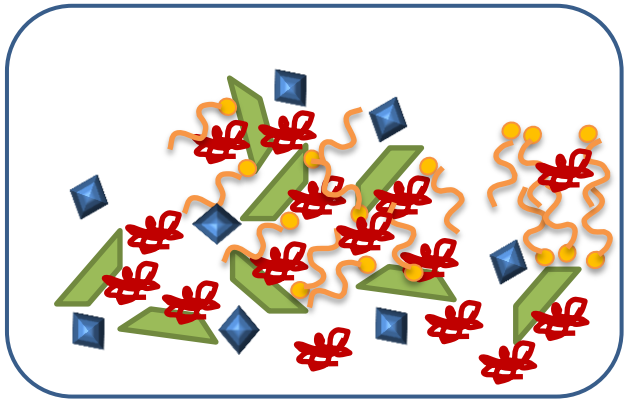
Thylakoid

Online 2014:legacy.hopkinsville.kctcs.edu



Rayner *et al*. 2010

SBL pellet: fractionation



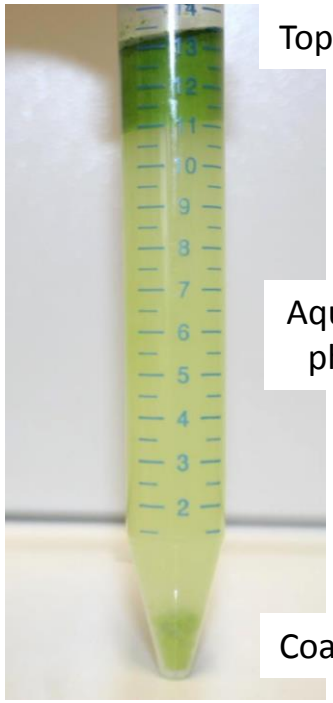
Surface active compounds

Viscous behaviour

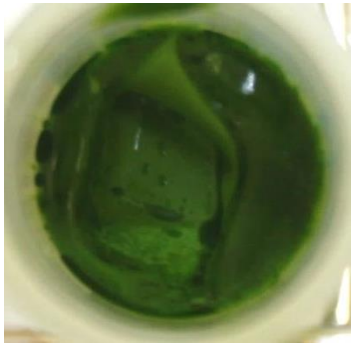
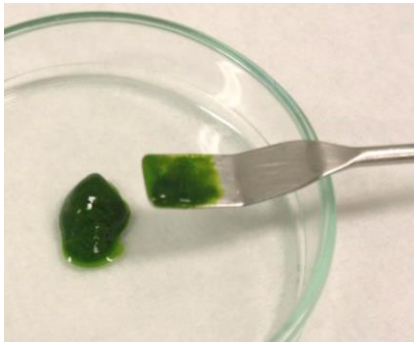
2. Functional properties of thylakoids and less purified membrane proteins

First results making emulsions:

- Thylakoids (isolate) from spinach, coming trials with SBL

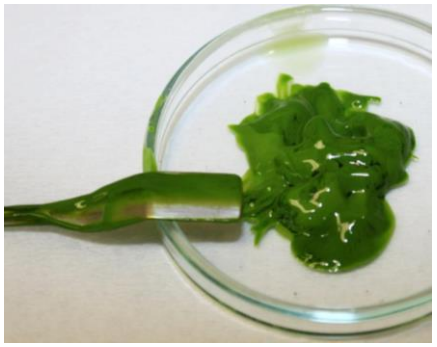


3 % protein

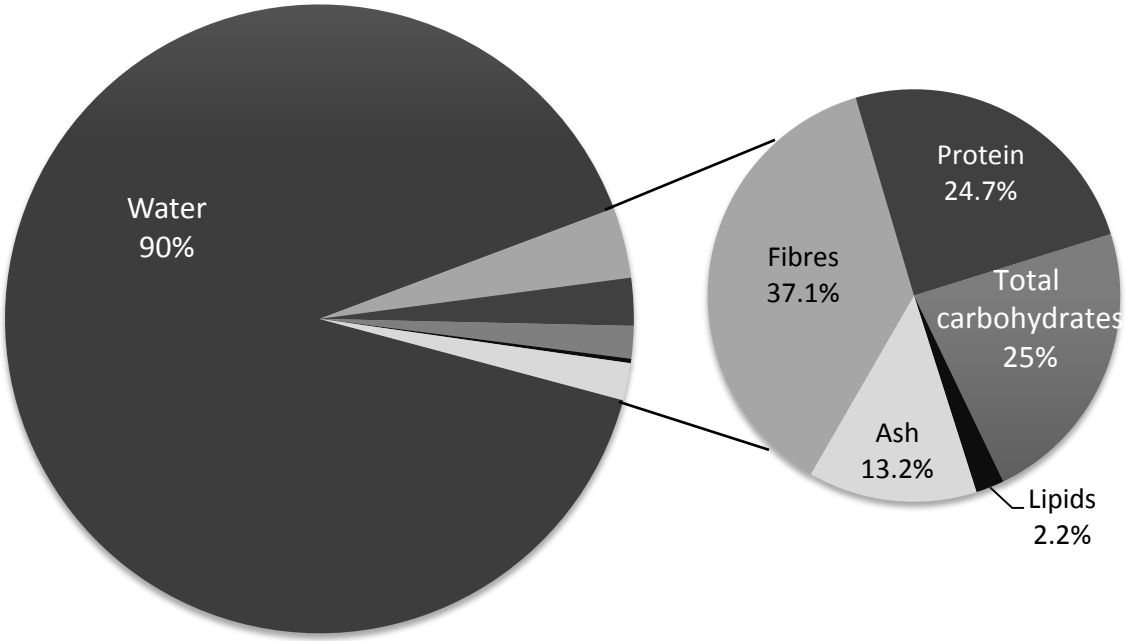




5 % protein



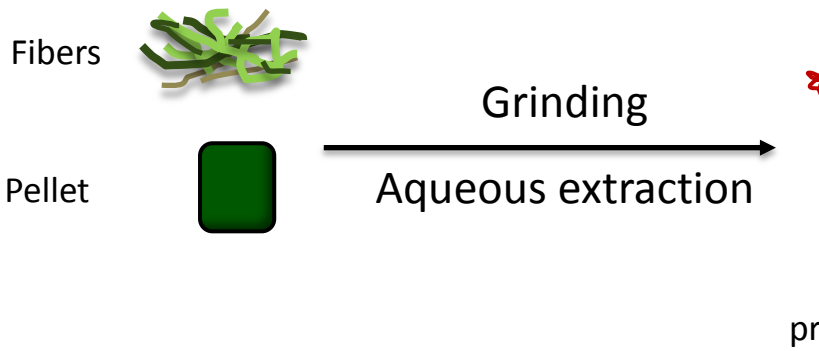


3. Aqueous extraction of SBL fibres and whole membrane protein fraction - applications



- Use natural complexes:
  - Protein-lipids
  - Protein-carbohydrates
- Applications

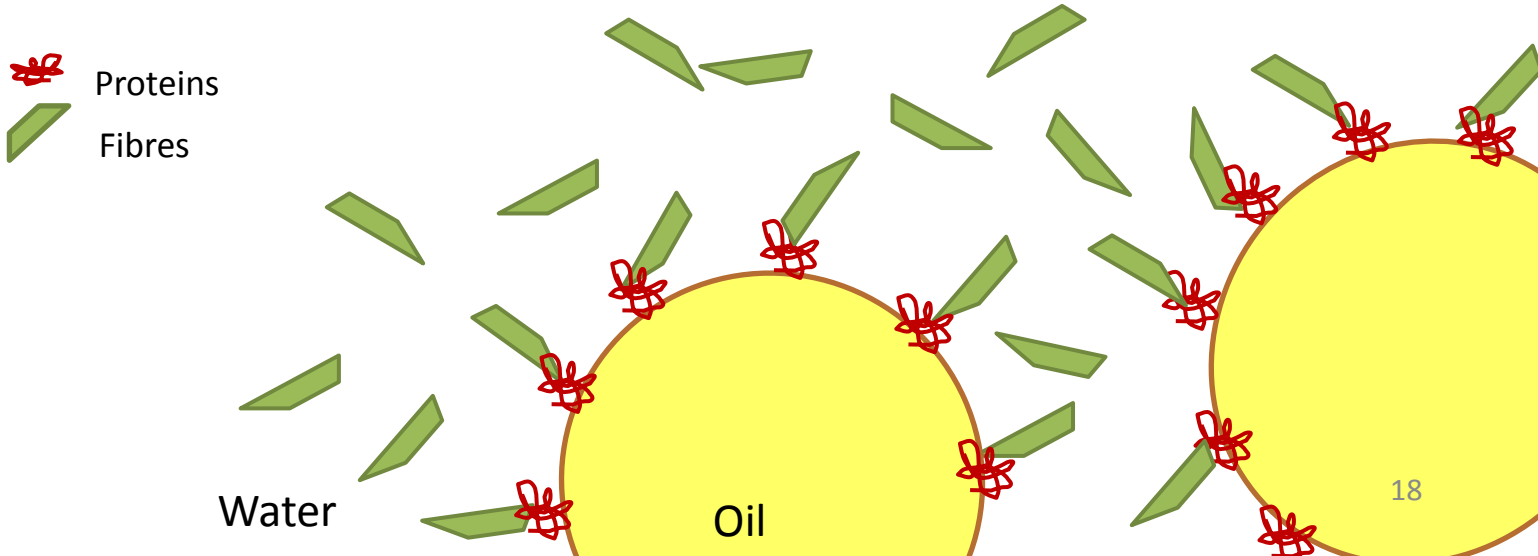
3. Aqueous extraction of SBL fibres and whole membrane protein fraction - applications



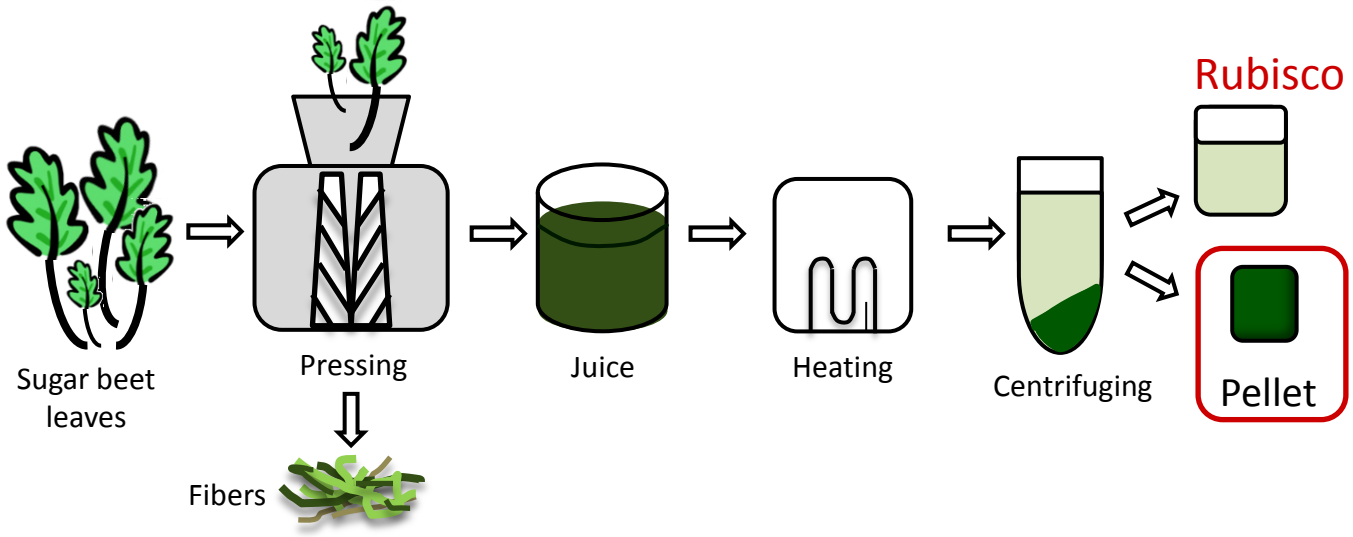
Stabilize emulsions

Change viscosity

Food structuring



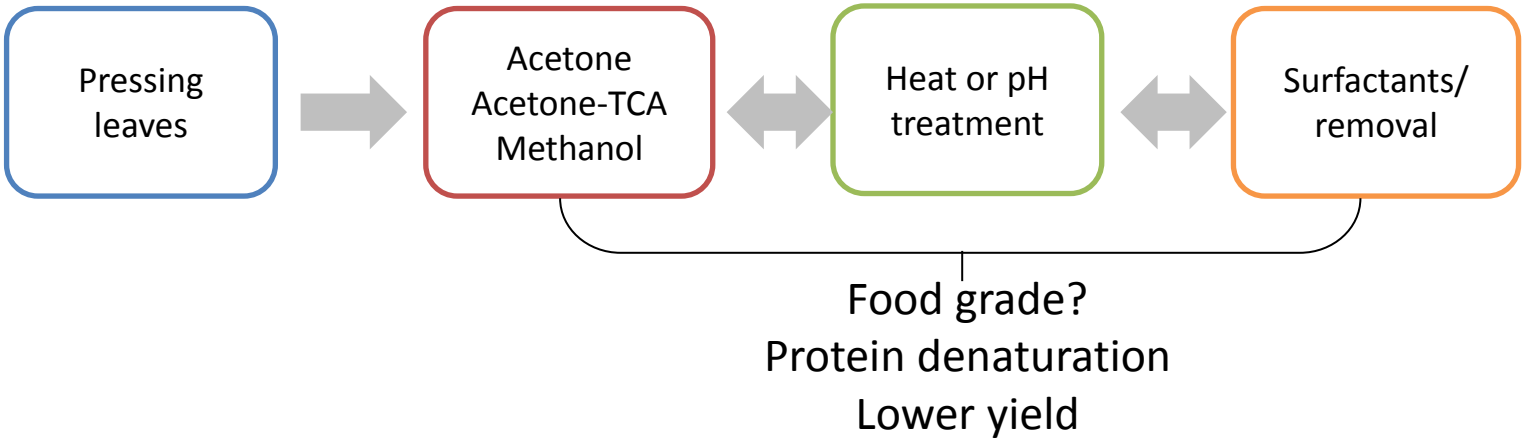
Summary



Seasonal material:

- Flexibility on harvesting time, but quick stabilisation is needed

Summary



Seasonal material:

- Flexibility on harvesting time, but quick stabilisation is needed

Extraction of membrane proteins:

- Sophisticated biomaterial structures (proteins, polysaccharides, lipids, pigments, etc.) and their functionality
- Potential of pure proteins vs. **functional fractions**

Future planning

- Finalising first publication:

  Process options towards the valorisation of protein from sugar beet leaves

- Research lines:
  1. Understanding the membrane protein fraction and biological structures
  2. Understanding functional fractions from SBL and their application on emulsion stabilisation
  3. Exploring the potential of aqueous extraction of SBL material and the functionality of extracted fractions

Thank you!