SUSTAINABLE PROTEIN TRANSITION

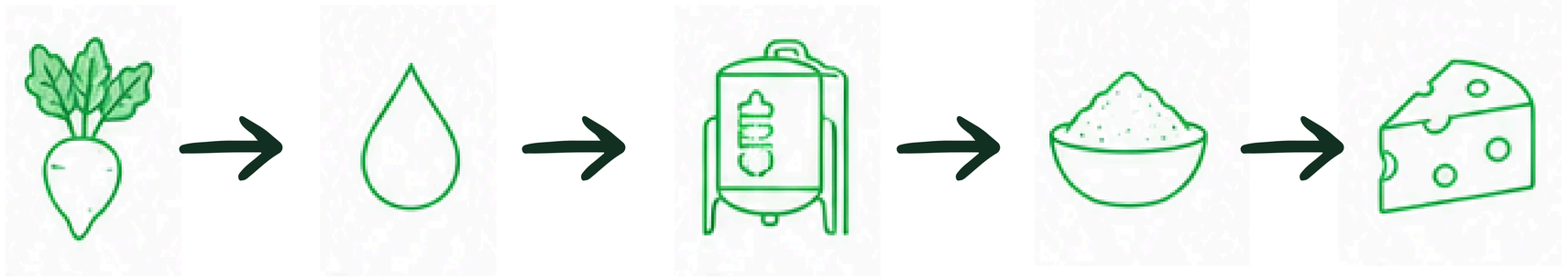
Designing a Sustainable and Cost-Efficient Supply Chain for Yeast-Based Casein Production

WHY THIS PROJECT?

Conventional dairy production contributes to greenhouse gas emissions, land use and water consumption.

Animal-free casein offers potential to improve food system sustainability and resilience.

Growing demand for sustainable protein alternatives drives interest in animal-free dairy.



SUGAR BEET
Renewable feedstock

THICK JUICE
Highly concentrated sugar solution

PRECISION FERMENTATION
Casein proteins produced through precision fermentation

CASEIN POWDER
High purity milk protein

ANIMAL-FREE CHEESE
Same functionality, no cows needed!



FEEDSTOCK SELECTION

Sugar beet sucrose selected as preferred feedstock

- Widely available in Europe.
- Existing processing infrastructure.
- Suitable carbon source after hydrolysis.



PRE-PROCESSING

Conversion of sugar beet into thick juice

- 60-70% Brix.
- Long storage stability Reduced transport volume.

KEY INSIGHTS

Large-scale centralized production aligns best with consortium objectives for sustainability, scalability and cost efficiency



PRECISION FERMENTATION

***Pichia pastoris* produces casein proteins**

- Centralized fermentation facility.
- Continuous production opportunities.
- Industrial biotechnology.



INDUSTRIAL SYMBIOSIS

Integration with existing industrial infrastructure

- Heat recovery.
- Water reuse.
- Biomass valorisation.
- Renewable energy integration.

RESULTS & CONCLUSION

SUSTAINABILTY

- Lower transport intensity through thick juice logistics
- Greater opportunities for industrial symbiosis
- Higher resource efficiency

COST EFFICIENCY

- Economies of scale
- Centralized procurement
- Better infrastructure utilisation

SCALABILITY

- Compatible with large fermentation facilities
- Easier integration with existing sugar industry
- Stronger future growth potential

RECOMMENDED SUPPLY CHAIN CONFIGURATION

The recommended supply chain consists of:

European sugar beet
↓
Centralized thick juice production
↓
Centralized precision fermentation
↓
Casein powder production

This configuration provides the best balance between sustainability, economic feasibility and industrial scalability.



TOWARDS ANIMAL-FREE DAIRY

Animal-free casein has the potential to reduce dependence on conventional dairy production while maintaining the functional properties required for cheese production.

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PROJECT CODE

25000411 BO4
Supply chain diervrije melkeiwit

Project number
NWA.1292.19.302

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Date of submission
15-06-2026

This publication is part of the 'Animal-free milk proteins' project (with project number NWA.1292.19.302) of the NWA research programme 'Research along Routes by Consortia (ORC)', which is funded by the Dutch Research Council (NWO).