FROM GRASS TO VALUE: REFINING GREEN BIOMASS FOR PROTEIN AND NUTRIENTS

Summary

Grass refining turns green crops into high-value protein, feed, and bio-based materials. trans4num supports this climate-friendly approach to boost soil health, reduce emissions, and strengthen circular farming in Denmark and beyond.

The need

Denmark's agricultural sector faces pressing environmental challenges—including nutrient surpluses, biodiversity loss, and oxygen depletion in inland waters. These issues are exacerbated by high levels of greenhouse gas emissions from conventional farming practices.

To address these impacts while maintaining high food production, there's a growing need for regenerative agricultural systems that are both economically viable and ecologically sustainable. This calls for a fundamental restructuring of how we grow food, use land, and manage nutrients.

Green leafy crops such as grass, clover, Lucerne, and nettle represent a promising solution. These crops not only thrive in Danish conditions, but also:

- Provide some of the highest protein yields per hectare
- Require no pesticide use
- Help store carbon and reduce nutrient leaching when grown continuously on the same land

At the same time, the global demand for sustainable protein sources is increasing—making the case stronger for transitioning to nature-based, locally adaptable food and feed systems.

The benefits

Climate and Environmental Gains:
Grass absorbs nutrients effectively and reduces nitrogen leaching. Long-term cultivation stores more carbon in the soil. Grass is pesticide-free, which supports soil microbial life and protects groundwater.

Biodiversity and Water Protection:
Green leafy crops (including those often seen as weeds) help preserve water quality and biodiversity in inland ecosystems like lakes and streams.

Farm Productivity:
Refining boosts the utility of farmland—protein is used for feed (poultry, pigs, cattle), while pulp and brown juice open additional value streams. Farmers gain more from the same land area.

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trans4num solution

What is Green Biorefining?

Green biorefineries work much like potato starch factories, using mechanical and thermal processes to separate plant components. Here's how it works:

- Leafy crops are pressed to extract green juice.
- This juice is heated (60–80°C) to precipitate protein.
- The resulting protein-rich paste is dried into a green powder (for animal feed) or further processed into a white protein fraction (for food).

What Happens to the Rest?

- Brown juice: Contains sugars and bioactive substances. Potential uses include:
  - Fermentation cultures
  - Biogas production
  - Natural fertilizers
  - Medical and industrial applications
- Pulp (press cake): Still rich in nutrients and fiber. It can be:
  - Fed to cattle, horses, and other livestock
  - Used for textiles, paper, or insulation
  - Further processed for biogas or bio-based materials

Optimizing Through Collaboration

Green refining becomes even more efficient when farmers and refineries work together. This ensures that:

- Crops are cultivated and harvested in sync with processing capacity
- Surplus biomass is redirected to livestock or alternative uses
- Nutrient flows are optimized across farming communities

This model of shared planning and logistics reflects the collaborative DNA of Danish agriculture, helping maximize both ecological and economic returns.

What were the challenges / limitations in the implementation process?

- Managing perishability of pulp (must be processed quickly)
- Scaling the refining process
- Coordinating supply between fields and refineries

What kind of resources do you need to implement the proposed solution?

- Biorefining infrastructure (factories, dryers, storage)
- Farmer-refinery logistics coordination
- Knowledge transfer & technical support

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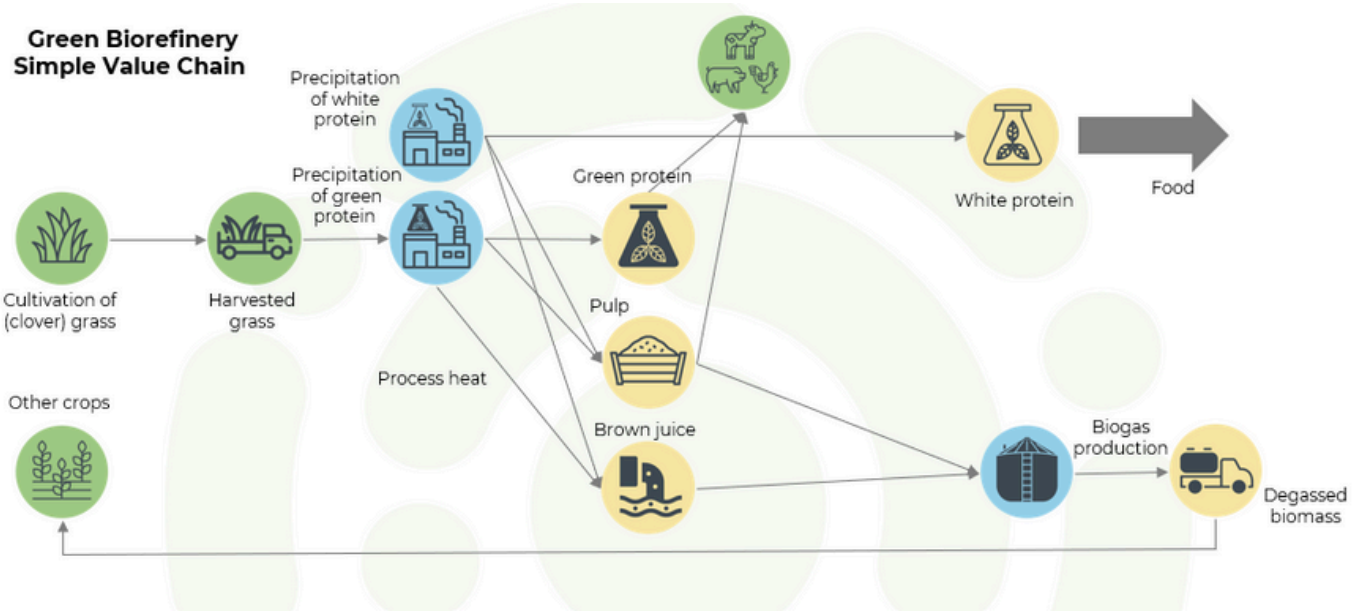
More information

Developing commercial products from pulp and brown juice still requires considerable innovation, but the potential is promising - especially since very large quantities of both can be produced.

trans4num Danish NBS site



Learn more about the project at https://trans4num.eu/en/

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