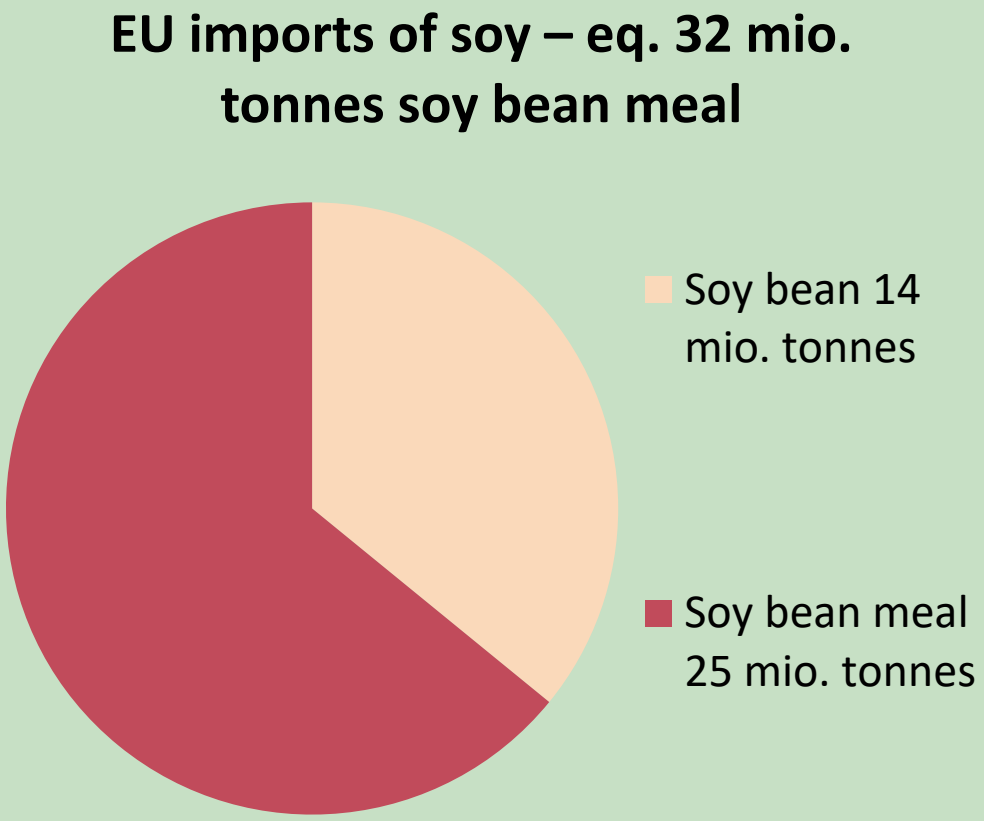
Danish policy, research and commercial developments on new, local protein sources

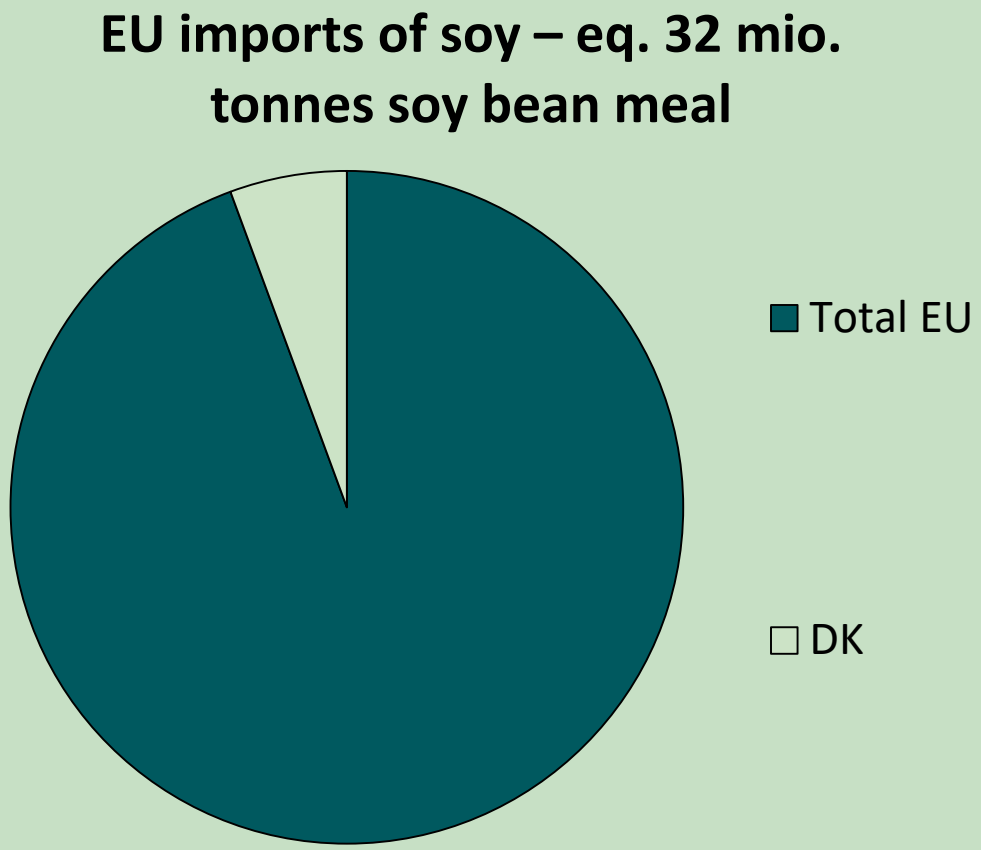
Senior Scientist Uffe Jørgensen, Department of Agroecology
Head of Aarhus University Centre for Circular Bioeconomy (www.cbio.au.dk)

With input from Asbjørn Børsting – chairman of the National Bioeconomy Panel

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement **N° 862674**

Total EU soy import and DK share 2019





Danish policy framework

- National Bioeconomy Panel
  - Strategy on new protein sources June 2018
- National funding of Demonstration plant and R&I
- High interest from stakeholders (farmers, feed industry, food industry, NGO's)
- Especially organic producers are on a burning platform for protein supply (annual exemption for 5% non-organic protein use)
- Danish Protein Innovation established by farm industries (www.proteininnovation.dk)
- National funding for support to first-of-its-kind commercial green biorefineries 2020 + 2021

The panel recommendations were adopted by a governmental action plan

The Danish Bioeconomy Panel is looking at how Denmark can become a frontrunner on bioeconomy?

Proteins for the Future

Recommendations from the Danish Bioeconomy Panel 2018

https://mfvm.dk/fileadmin/user_upload/MFVM/Miljoe/Biooekonomi/Recommendations_from_the_National_Bioeconomy_Panel_Proteins_for_the_future__PDF_.pdf

Det Nationale
BIOØKONOMI
Panel

Vision

”Within five years alternative Danish protein products with a better environmental and climate footprint can match existing protein products regarding price and quality in key market fields within feed and food.”

How the panel has worked

New proteins from land

New proteins from sea

New proteins from residual and secondary flows

Food
(such as ingredients for food production and insects)

Feed
(such as protein additives to feed mixtures)

Other products
(such as pharmaceutic as and fertiliser)

Targets

1

Within five years a commercial production of sustainable protein-rich raw materials from landbased production, aquatic sources, and from industrial residual and secondary flows has been established.

2

In a relatively short number of years, close to one third of Denmark's imports of feed proteins has been replaced by feed proteins based on Danish protein sources. Danish produced protein sources must be economically and environmentally sustainable, and the functionality of the products must be at least equal to that of existing products

3

Danish companies have established solid business cases for biorefining of protein-rich land and marine-based biomass and of industrial secondary flows.

4

The Danish market for new protein products for feed and food has increased by more than 50 percent annually, knowledge is available on environmental and climate footprints, and there is transparent traceability

5

There is an ambitious political orientation towards a sustainable bioeconomy in Denmark. Strong partnerships exist for biorefining, among others, and companies have easy access to public and private capital

15 recommendations for national action

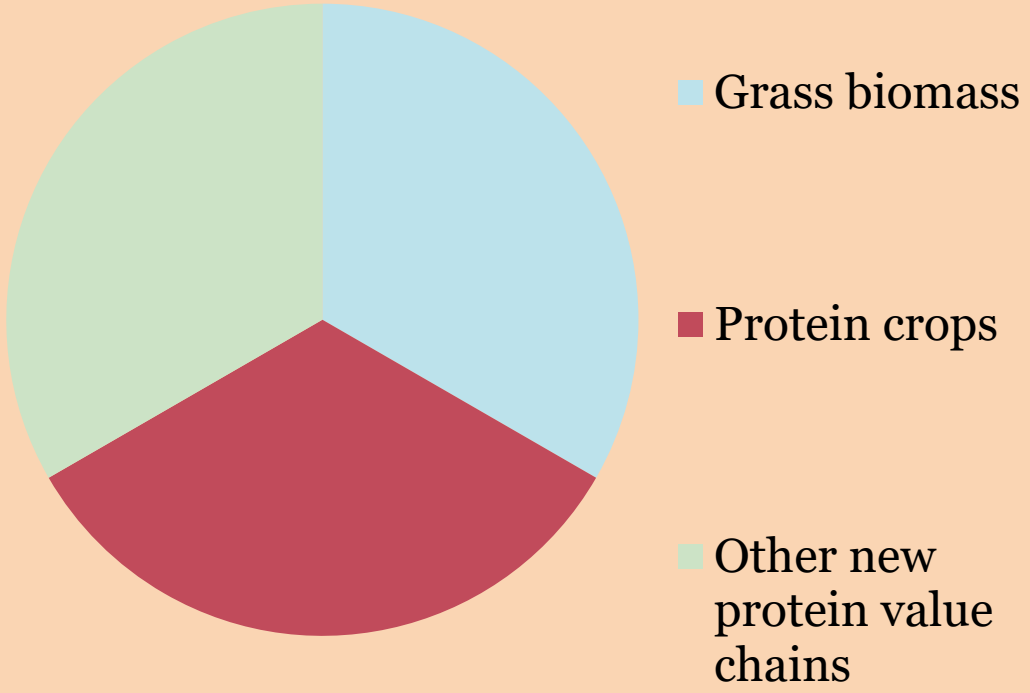
6 are on bioeconomy in general:

1. A bioeconomy strategy
2. Coordination of investments in Research, development and Innovation
3. More funds to bridge the valley of death
4. Incubation and acceleration facilities for SME and start-ups
5. Activate venture capital
6. Skills and competences

9 protein specific:

7. Research and development in raw materials for new protein value chains.
8. Recognition of sustainable biomass production in national environmental regulation.
9. Improved EU framework conditions for sustainably produced proteins
10. Stronger coordination among stakeholders
11. Support for research, development, and establishment of biorefineries
12. More knowledge about market and consumer demand
13. Consensus on environmental and climate footprints of proteins
14. Support for nutritional and toxicological studies
15. Secure that traceability systems underpin new protein products for food and feed.

Three development tracks



Track 1

Perennial grasses/clovers – an efficient utilisation of arable land

Track 2

New faba bean varieties for Danish production of protein

Case: Faba beans

<u>Research project on new faba bean varieties.</u>

NORFAB: Protein for the Northern Hemisphere

Supported by the Danish Innovation Foundation

CROP INNOVATION DENMARK

- *from genes to seeds*

Track 3

Other new protein value chains; eg. Starfish, mussels, insects and seaweed

SEASUSPROTEIN

Harvest of green tide algae (*Ulva*) for protein functional foods

- Coupling of AU pilot platforms for cultivation, processing and analysis of different biomasses
- Improving TRL: harvest technology to TRL 7 & processing technology to TRL 5-7

- Environmental benefits – circular bioeconomy
- Climate benefits – reducing N2O & CH4 emissions

Dansk Protein Innovation

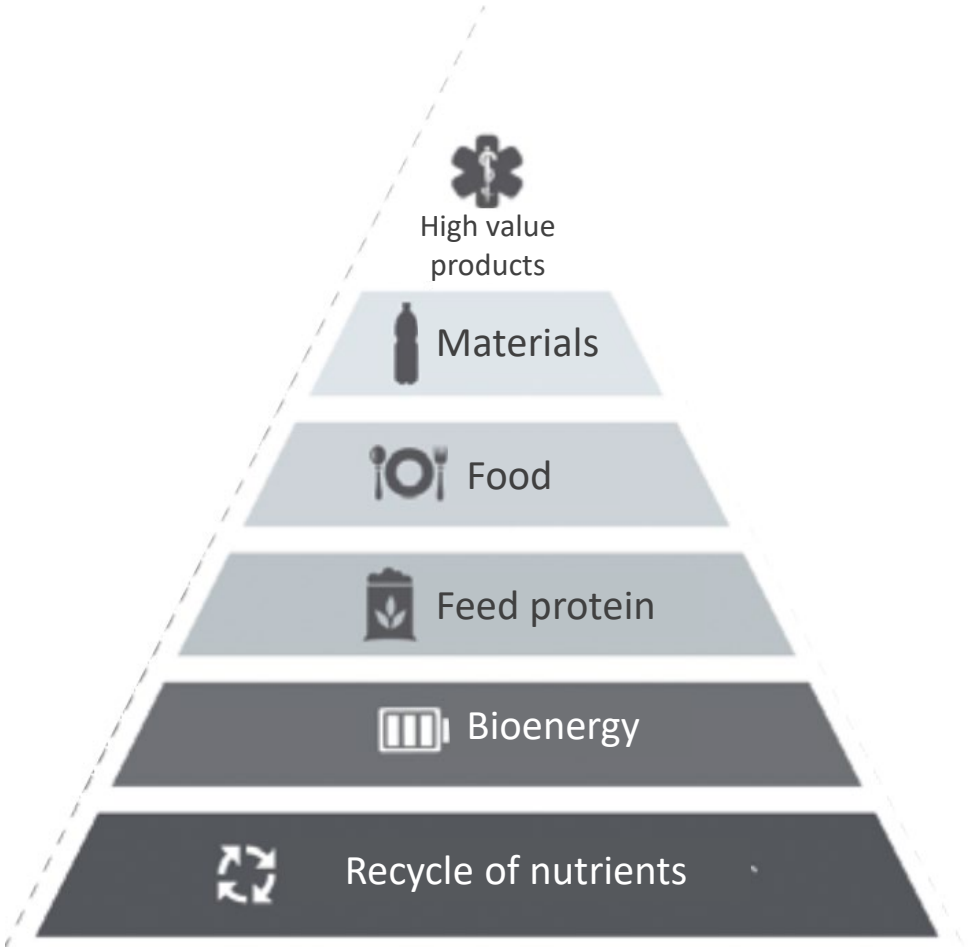
Strategy
May 2019

”Enhanced effort for more sustainable production of Danish protein”

DPI’s vision

DPI's vision in the short term is to create the framework that makes it possible to increase domestic production of sustainable protein to feed.

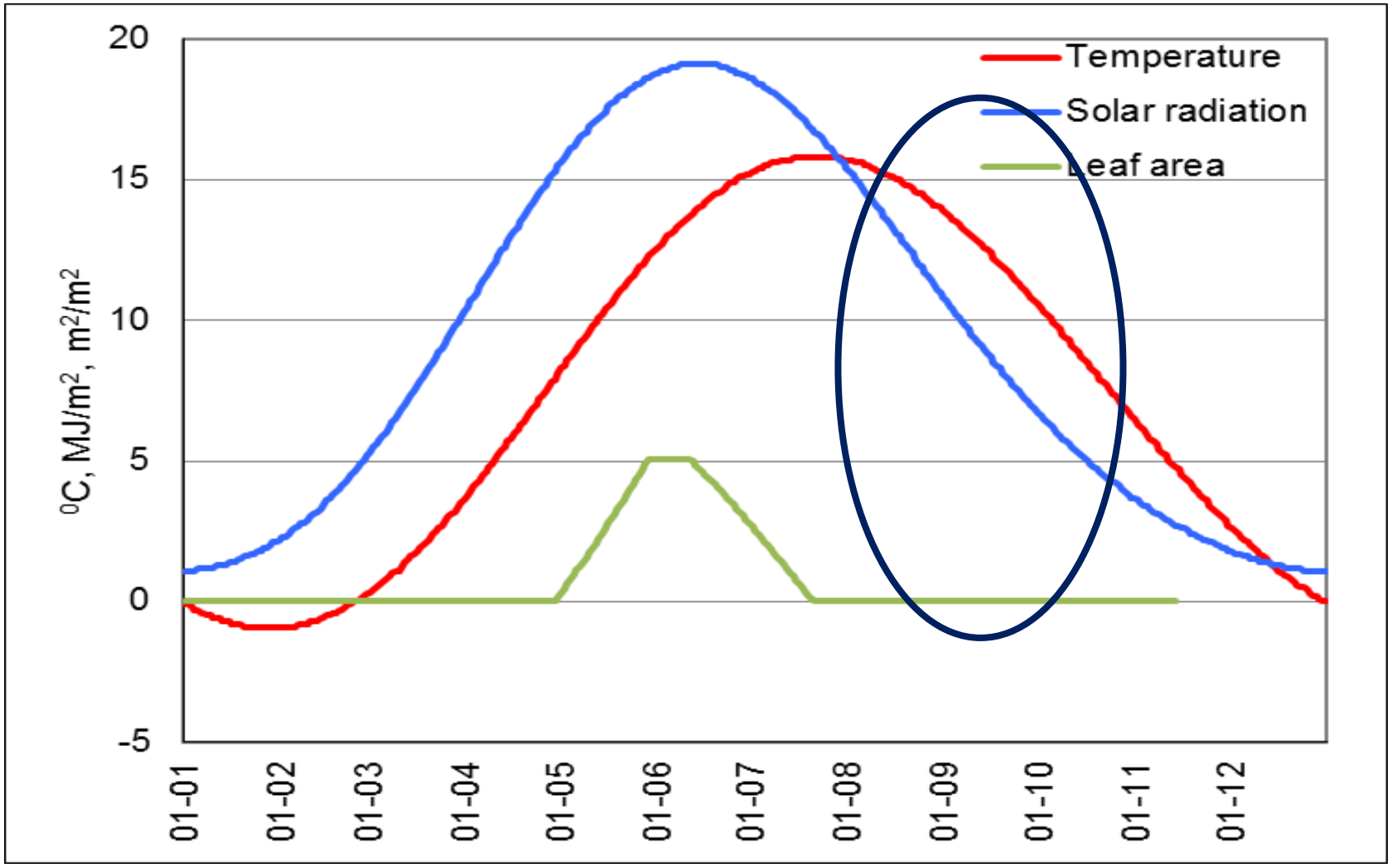
DPI's vision in the longer term is to create the framework for the full potential of the biomass to also be used for the sustainable production of protein for food and other high value products.



The rationale for using grassland for protein concentrate production

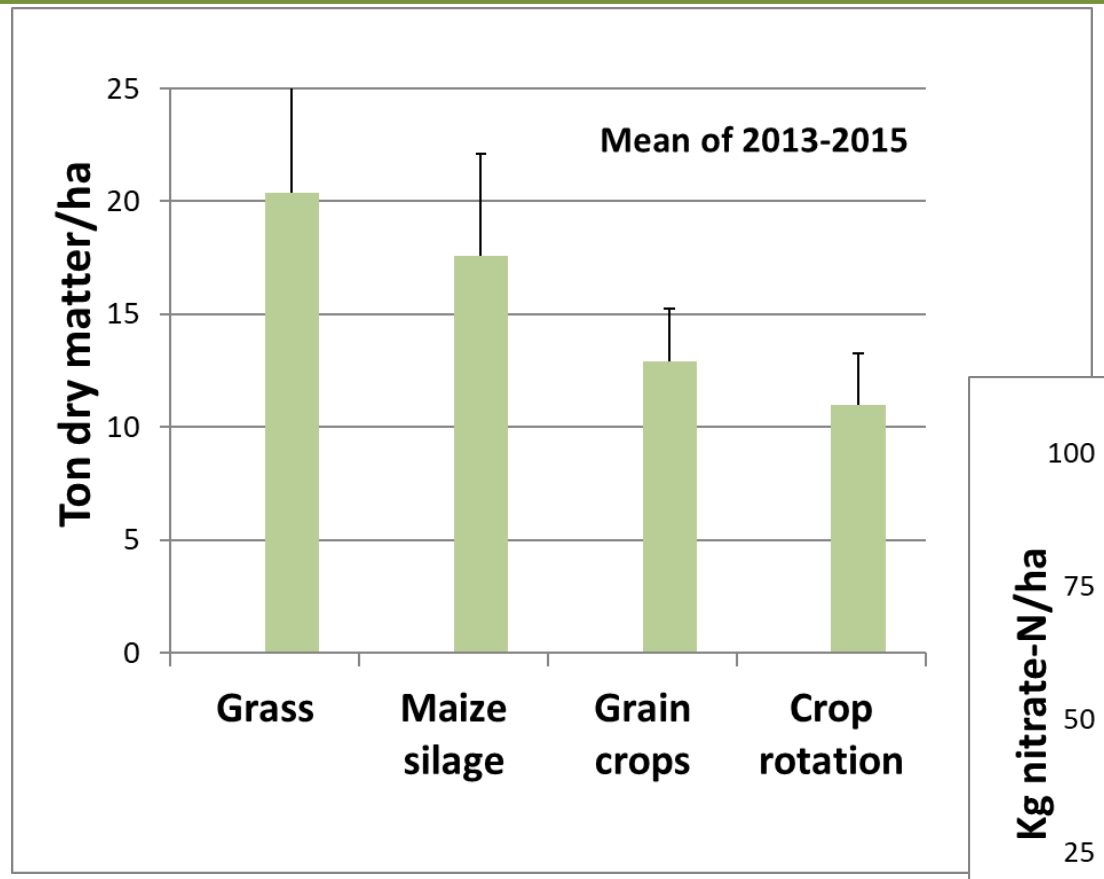
Why produce grain crops that utilize only part of the growing season?

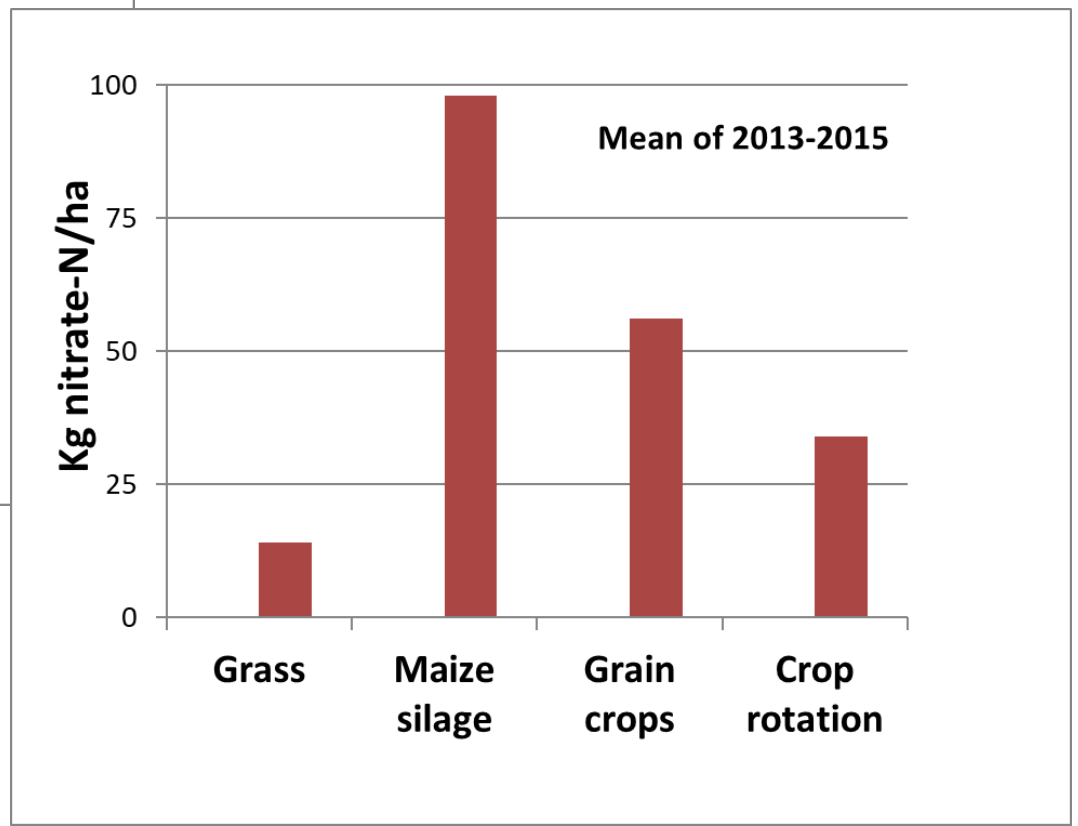
Case: spring barley in Denmark



Field experiments at Aarhus University on the effects of cropping systems

Biomass production can be doubled and nitrate leaching halved





Manevski et al., 2017; 2018

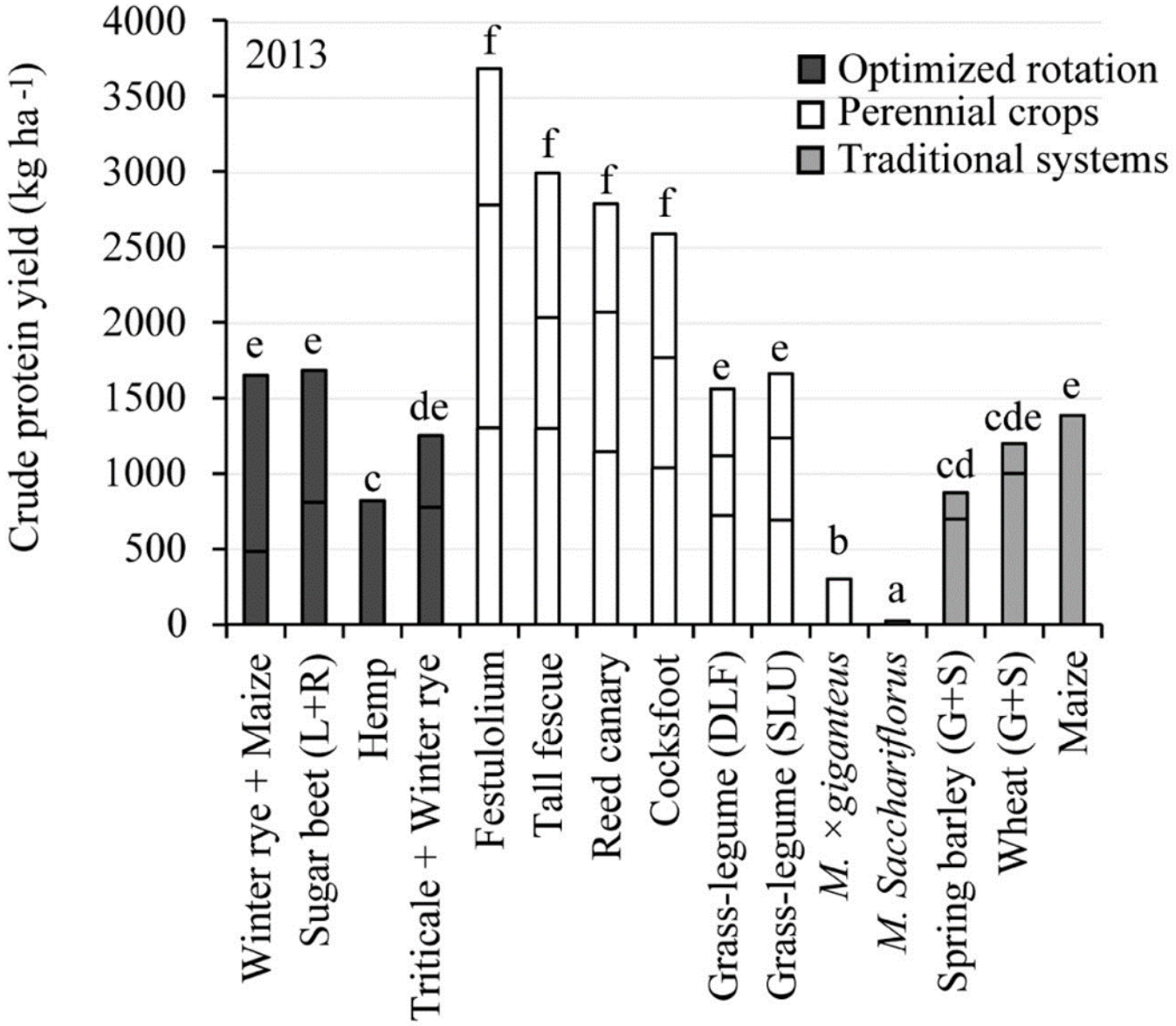
Other environmental benefits from conversion of annual crops to grass, clover or alfalfa

- Reduced soil erosion
- Reduced GHG emission (0.5-3.5 ton CO_2-equiv/ha)
- Reduced pesticide use (by factor 40-50)
- Increased biodiversity

Børgesen et al., DCA Report No. 131, 2018

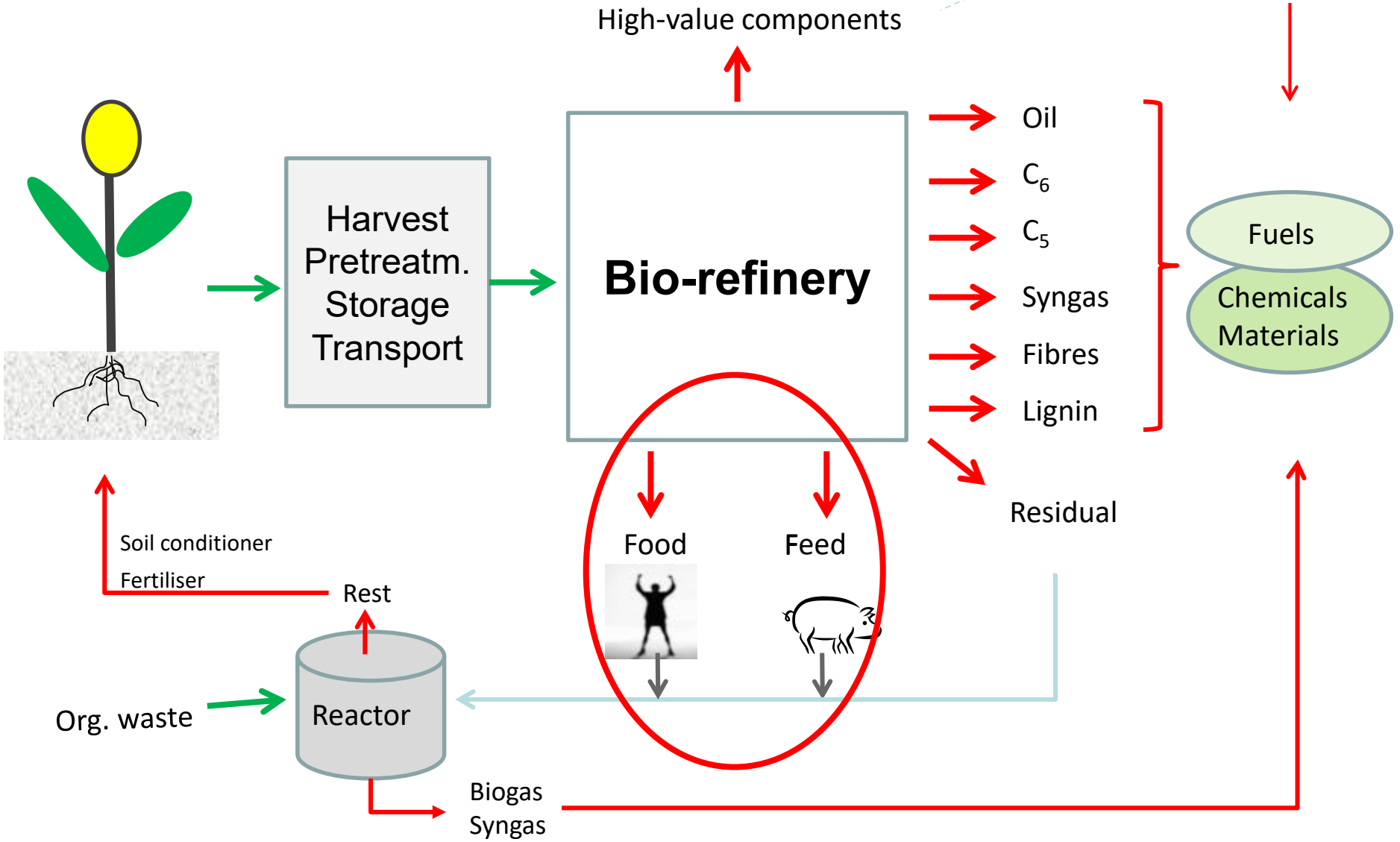
So, what to do with all that grass?

Crude protein yield higher in grass than in any other crop

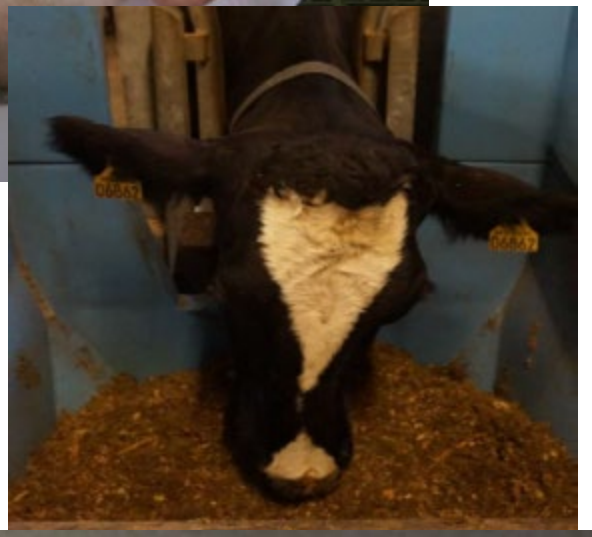


Solati et al., 2018

Green biorefineries can be the disruptive agents for new products from rural areas



Feeding experiment with green protein to pigs, cows, broilers & egg layers – positive results!



Business evaluation of decentralized green biorefineries in Denmark

Economic assumptions:

- Biorefinery CAPEX : 3.36 mio EUR
- Depreciation time: 15 year
- 5% Interest rate , 5% Maintenance

- Grass price
- Organic: 0.15 EUR/kg
- Conventional: 0.13 EUR/kg
- Protein price (soya)
- Organic: 0.67 EUR/kg
- Conventional: 0.34 EUR/kg
- Fiber pulp price
  - Identical to grass price

- Residue juice is not given any cost or value - It is used for internal energy production at the biogas plant.

Economy	Scenario	
	Organic	Conventional
	Mio. EUR	Mio. EUR
Income		
Protein concentrate + Fibre	4.70	3.25
Expenses		
Grass	3.33	2.90
Energy and salary	0.19	0.19
Maintenance	0.17	0.17
Depreciation and interest	0.32	0.32
Result	**0.66**	**-0.34**

Source: Morten Ambye-Jensen

CBIO
AARHUS UNIVERSITY CENTRE FOR CIRCULAR BIOECONOMY

Demo-plant for green biorefinery now paving the way for market introduction

Supported by public funding, Arla, Danish Crown, DLG & DLF

GO-GRASS

Green Valleys

Interreg

Öresund-Kattegat-Skagerrak

European Regional Development Fund

EUROPEAN UNION

CBIO

AARHUS UNIVERSITY CENTRE FOR CIRCULAR BIOECONOMY

gudp

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement **N° 862674**

Green biorefineries can disrupt agricultural systems by creating new markets - and ensure

CBIO
AARHUS UNIVERSITY CENTRE FOR CIRCULAR BIOECONOMY

Thank you


Recommendations from the National Bioeconomy Panel
Proteins for the future
The Danish National
BIOECONOMY
Panel