AU CENTRE FOR CIRCULAR BIOECONOMY –
RESEARCH ON INCREASING PRODUCTION SYSTEM EFFICIENCY, REDUCING ENVIRONMENTAL AND CLIMATE IMPACTS, AND DEVELOPING NEW BUSINESS CASES WITHIN THE BIOECONOMY

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AARHUS UNIVERSITY CENTRE FOR CIRCULAR BIOECONOMY

OCTOBER 16 2019 | UFFE JØRGENSEN
HEAD OF CENTRE

WE ARE ON TRACK RECYCLING OF AGRICULTURAL BIO-RESOURCES – BUT THERE IS STILL A LOT TO DO

AU THEMATICAL CENTRES

New strategical interdisciplinary thematical centres within global challenge areas:

Circular Bioeconomy

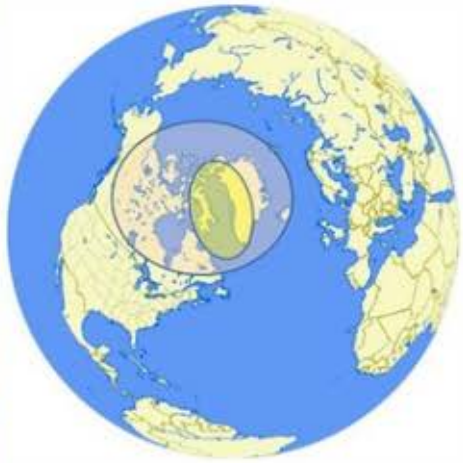
Integrated Materials Research

Water Technology

Digitization, big data, and data analytics

iFood

iClimate



Arctic Research

CBIO IS ORGANISED AROUND 7 RESEARCH PILLARS

Production and manegement of agricultural biomass
Senior Reseacher
Uffe Jørgensen
Department of Agroecology

Environmental Credibility, Economic Feasibility and Social Acceptance
Professor Marianne Thomsen
Department of Environmental Science

Production of marine biomasse
Senior Reseacher
Annette Bruhn
Department of Bioscience

Utilization of biomass for food, Ingredients and high-value products
Associate Professor
Trine Dalsgaard
Department of Food Science

Biorefining, conversion and recycling
Senior Reseacher
Lars Ottosen
Department of Engineering

Biobased materials and bio-oils
Associate professor
Marianne Glasius
Department of Chemistry

Feeds, by-products and feed ingredients
Senior Reseacher
Søren Krogh Jensen
Department of Animal Science

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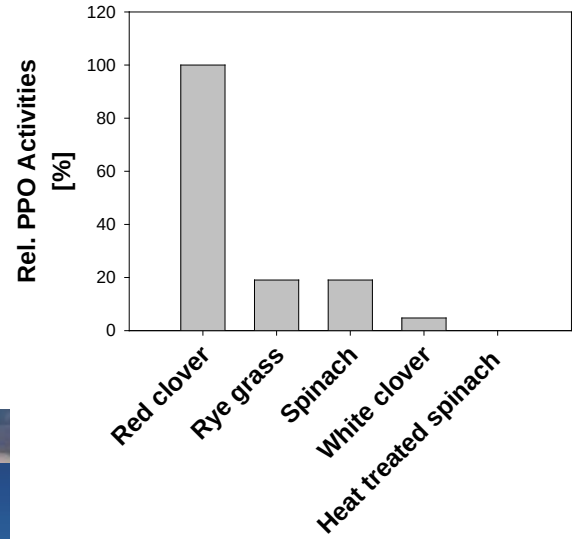
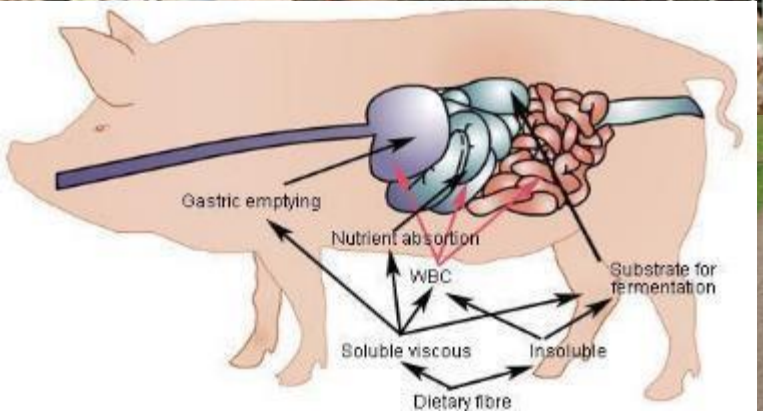
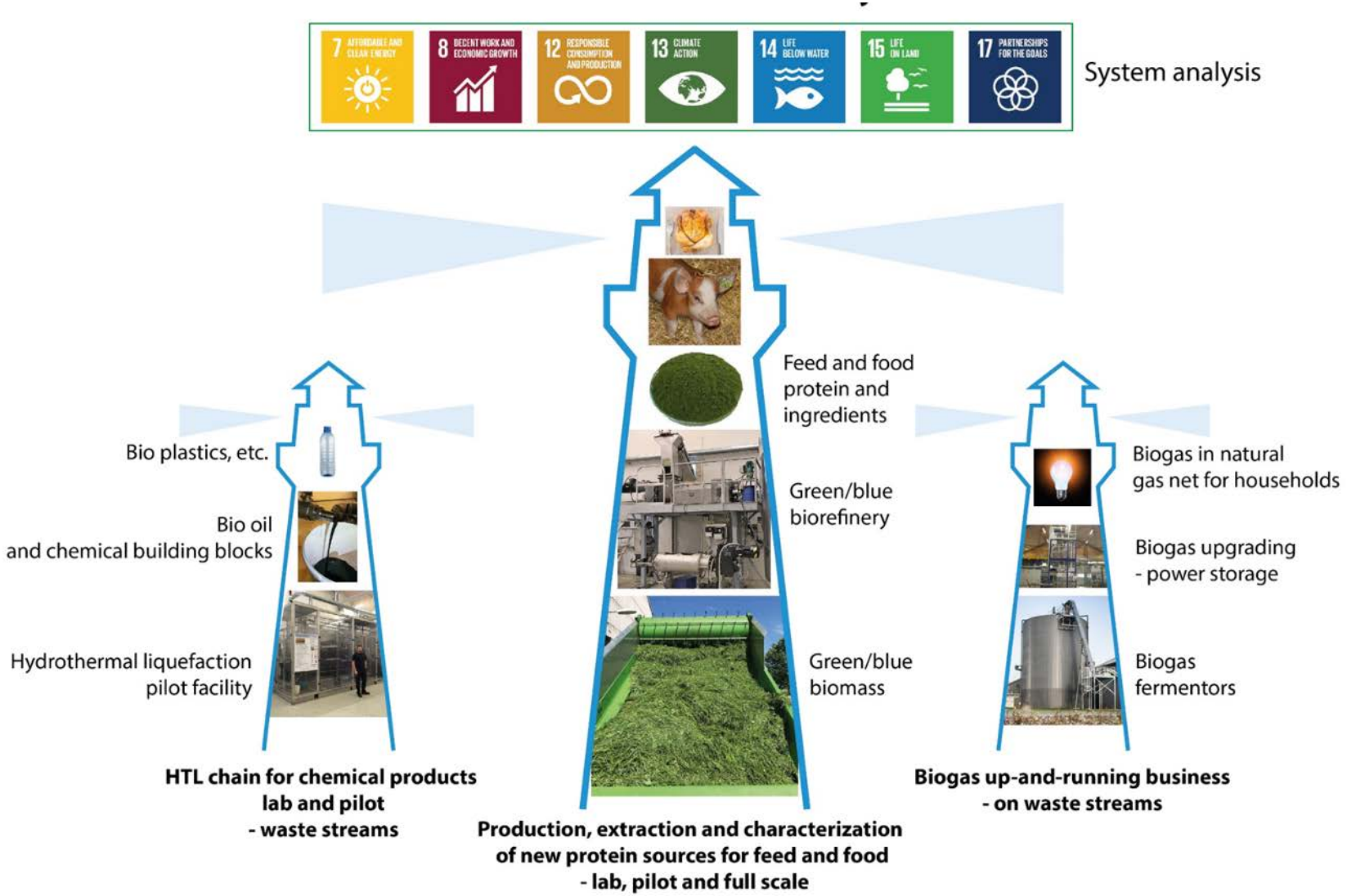
KEY CBIO MISSION IS TO COUPLE UNIQUE RESEARCH PLATFORMS WITHIN THE UNIVERSITY



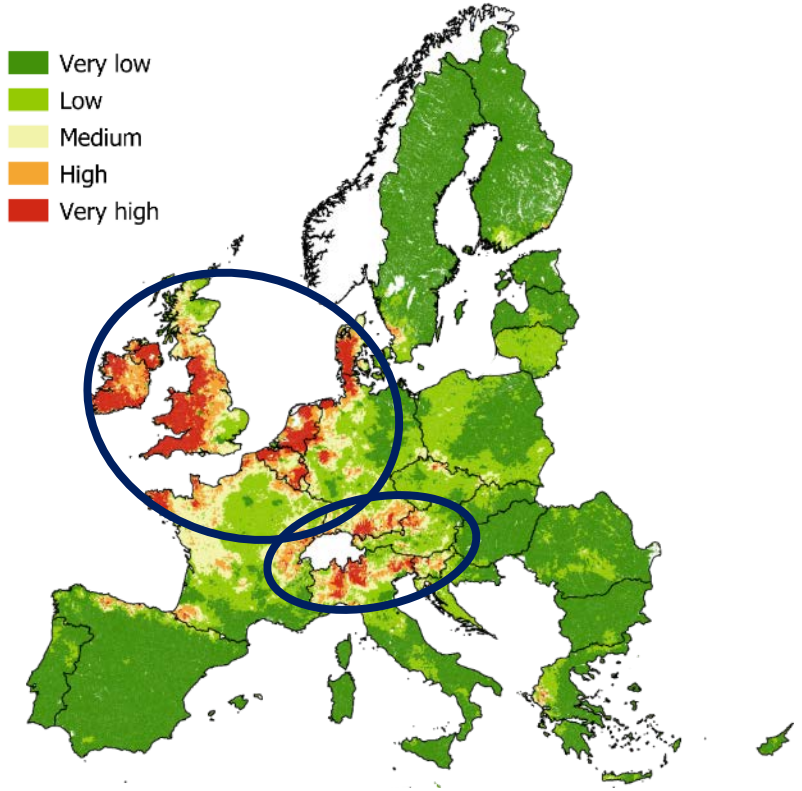


CBIO LIGHTHOUSES WITH MAJOR R&D FOCUS

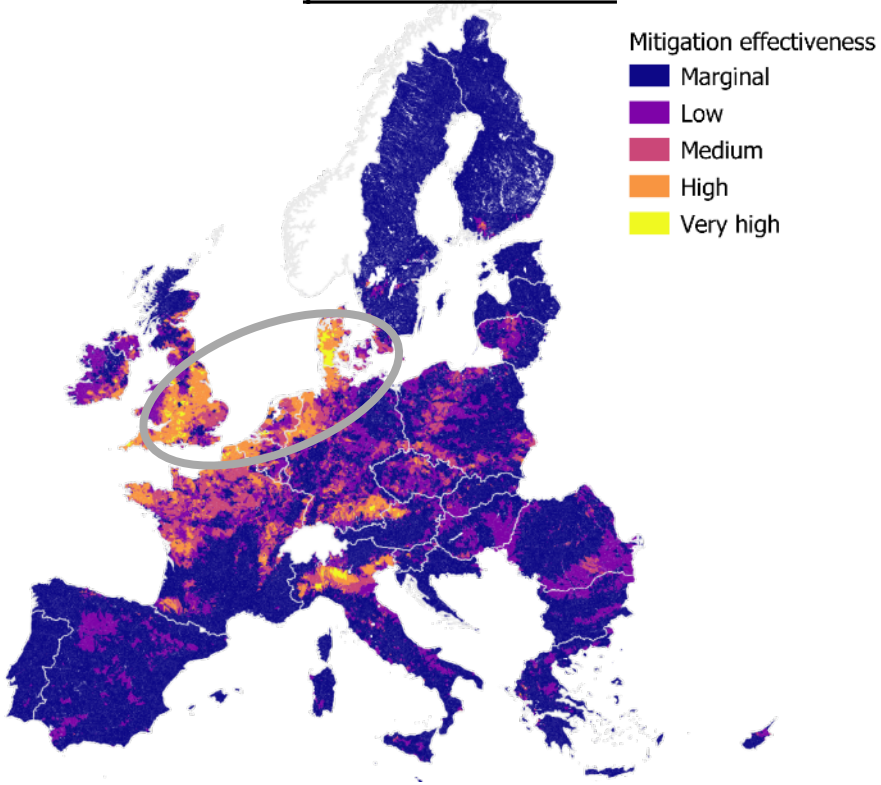


THERE ARE STRONG DRIVERS FOR CHANGE IN AGRICULTURE - E.G. N-LOSSES TO WATER FROM AGRICULTURAL LAND (*ENGLUND ET AL., 2019*)

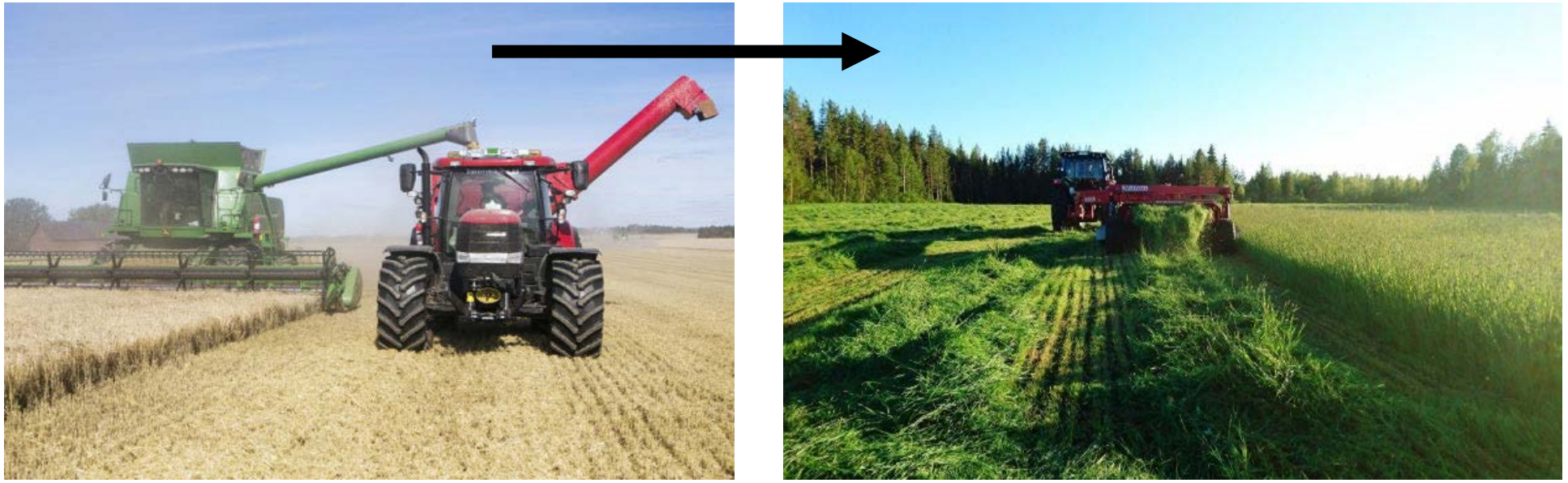
Degree of current impact



Effectiveness of strategic perennialization



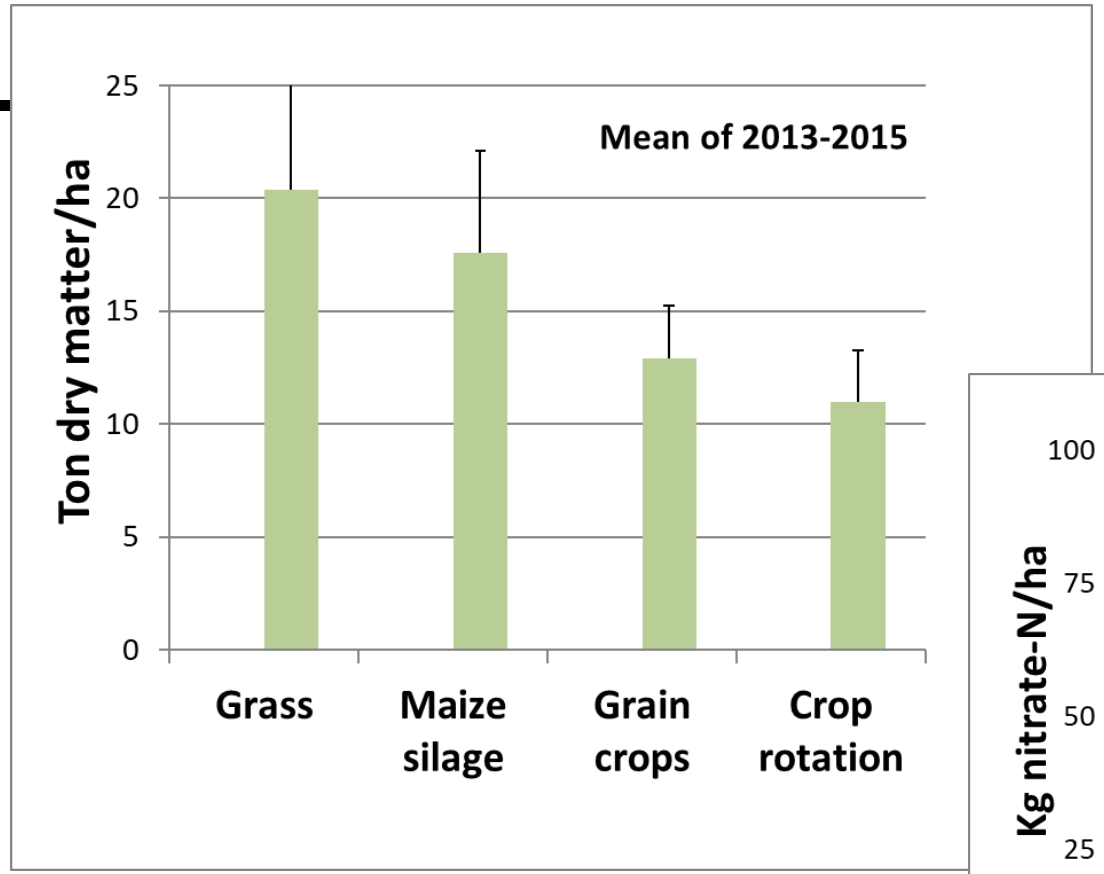
STRATEGIC PERENNIALIZATION
EXAMPLE

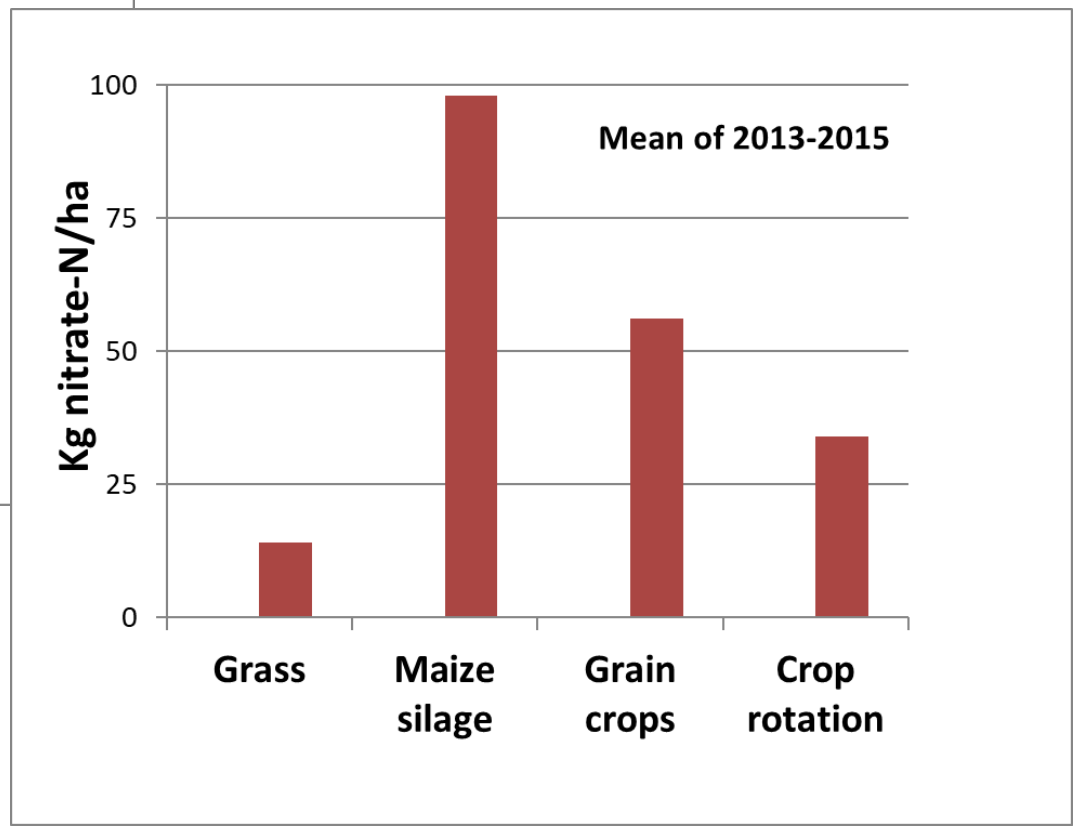


FIELDS CAN LOOK THIS DIFFERENT IN AUTUMN – WE DECIDE

BIOMASS PRODUCTION CAN BE DOUBLED

and nitrate leaching halved





Manevski et al., 2017; 2018

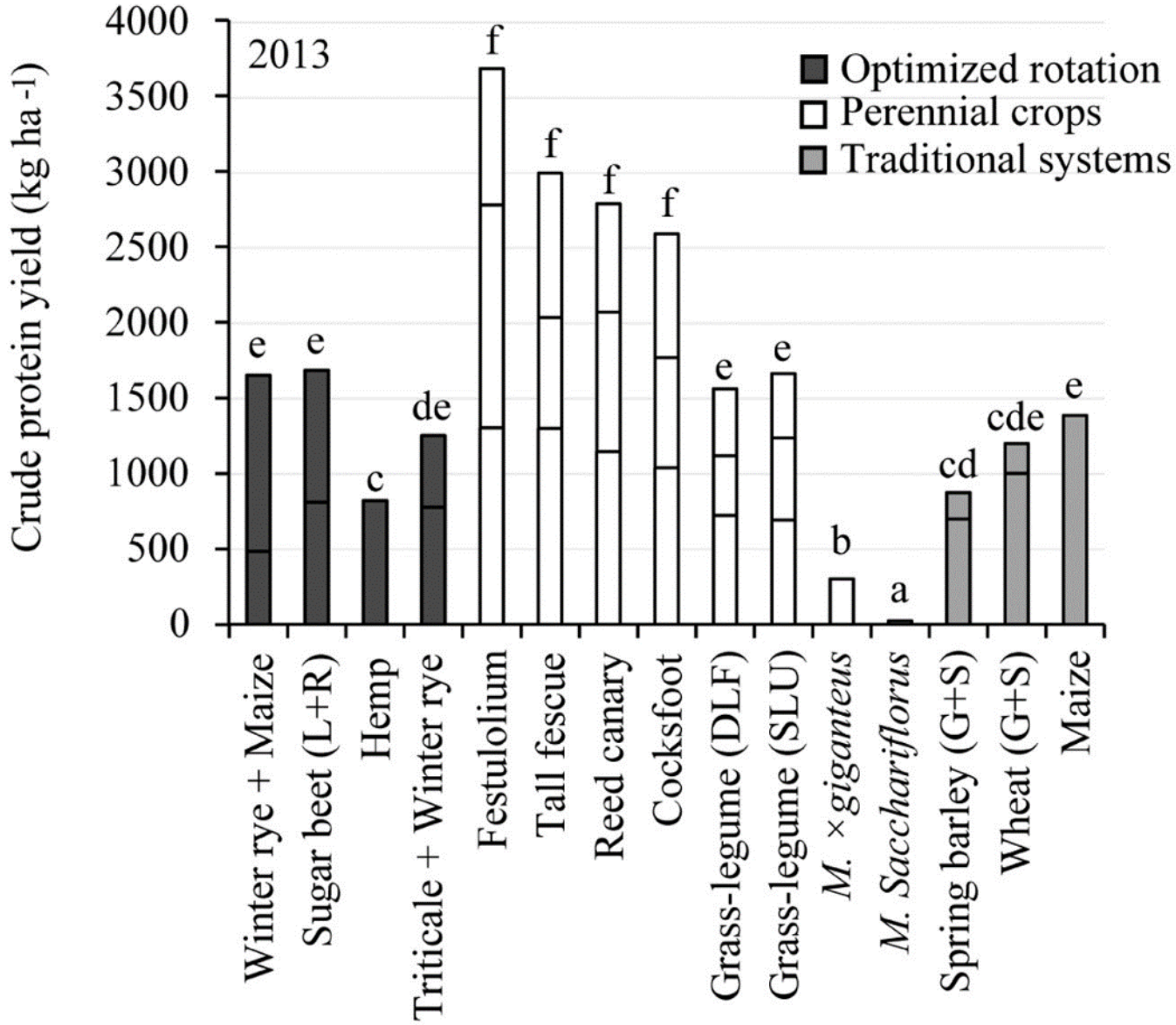
OTHER ENVIRONMENTAL BENEFITS FROM CONVERSION OF ANNUAL CROPS TO GRASS

- 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 GRASSES THAN IN OTHER CROPS



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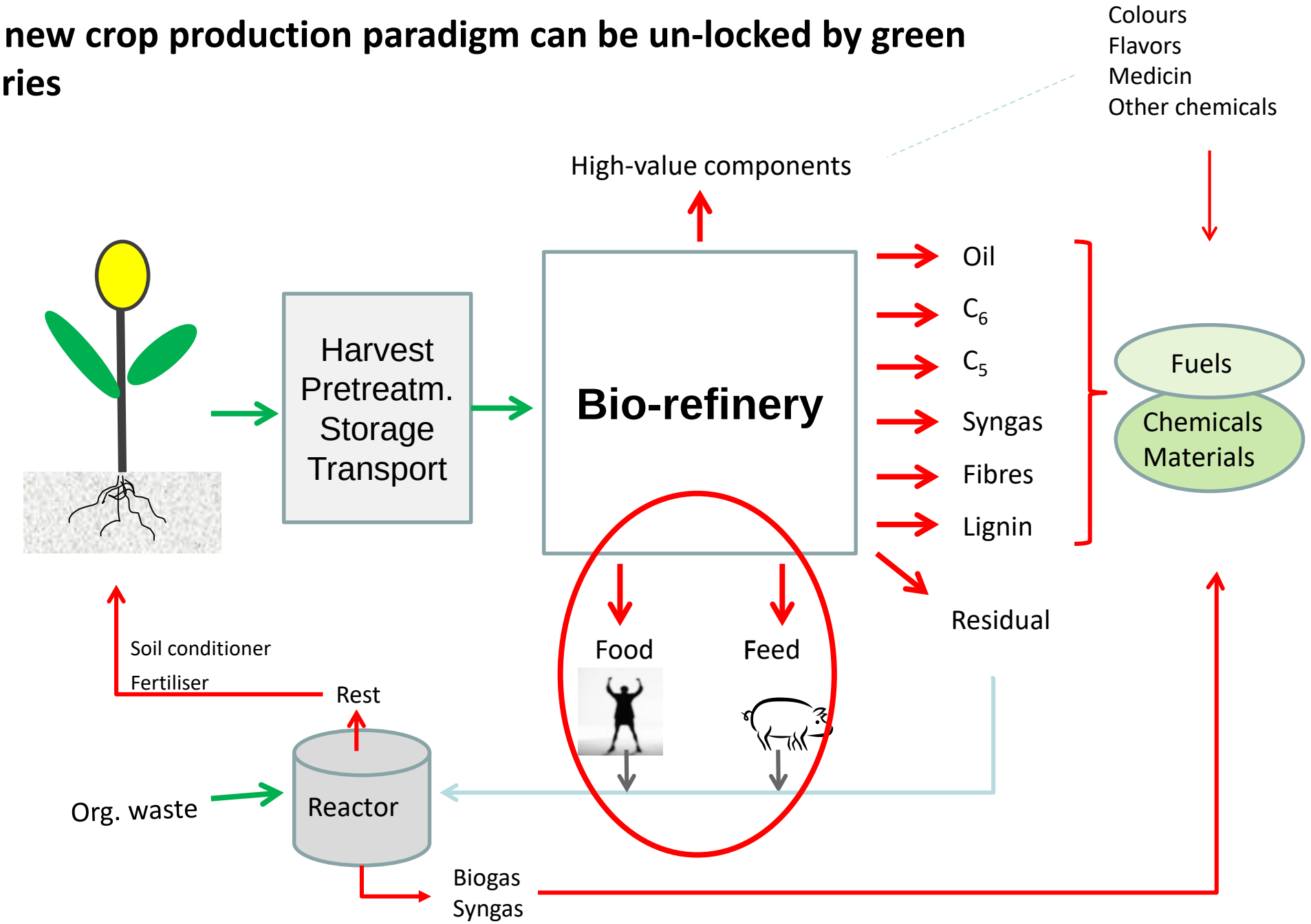
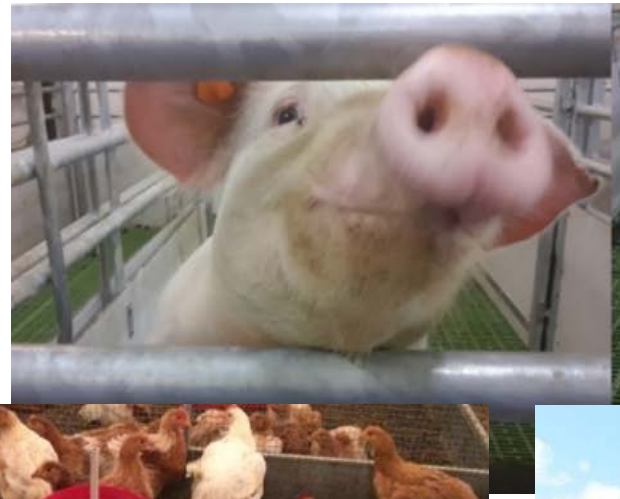
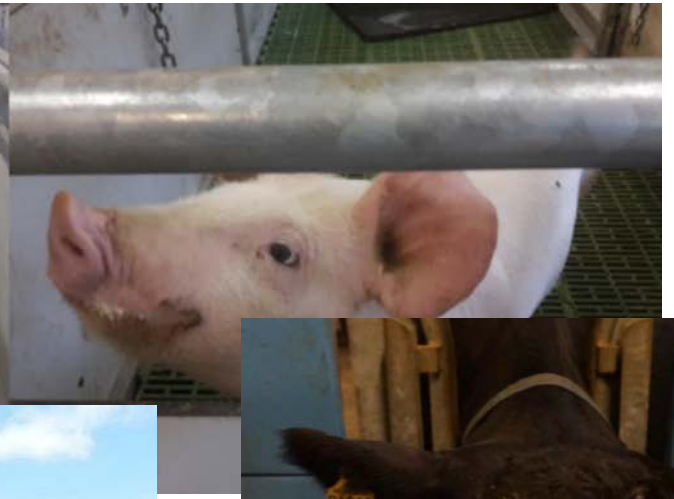
Solati, Z, Manevski, K, Jørgensen, U, Labouriau, R, Shahbazi, S & Lærke, PE 2018. Industrial Crops and Products 115, 214-226.

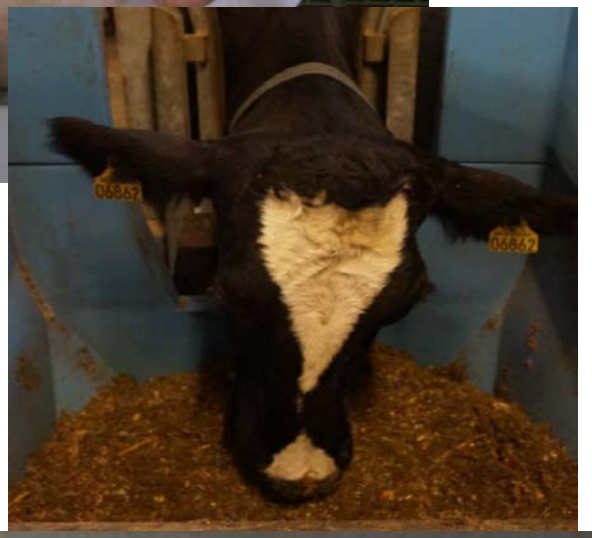
A radical new crop production paradigm can be un-locked by green biorefineries



Feeding experiments with green protein to pigs, cows (also fibres), broilers & egg layers






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
- Organic: 0.67 EUR/kg
- Conventional: 0.34 EUR/kg
- Fiber pulp price
  - Identical to grass price

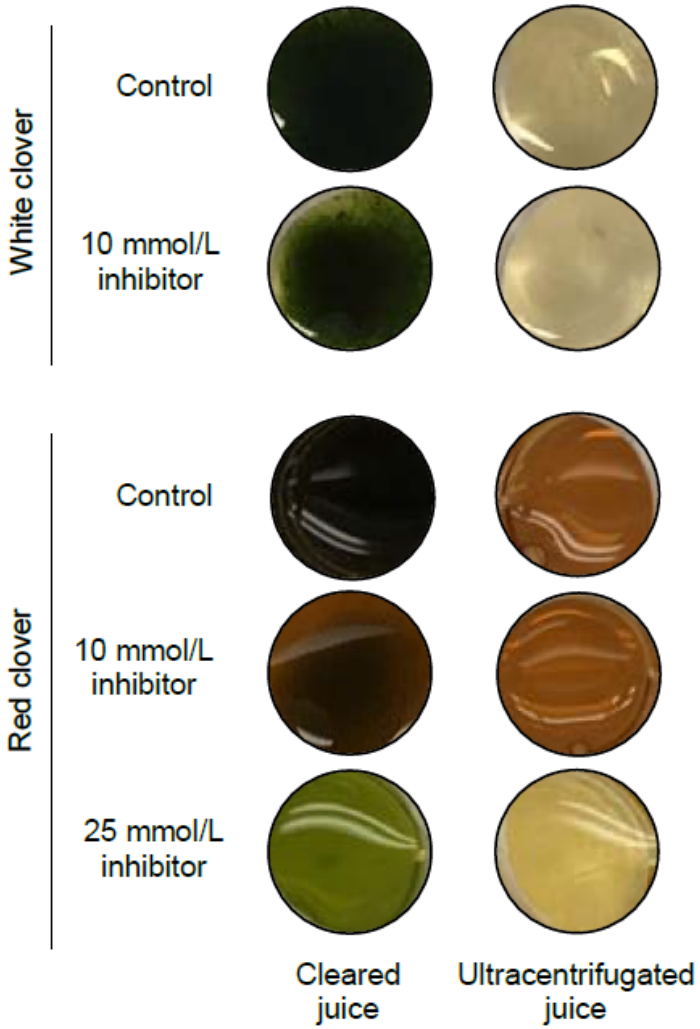
- Residue juice is not given any cost or value - It is used for internal energy production at the biogas plant.

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

Green protein for food purposes will increase product value
However, still R&D and Novel Food regulation to tackle

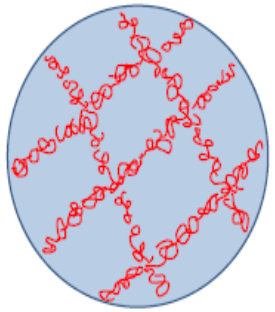
Reduction of indigenous polyphenol oxdiase activity

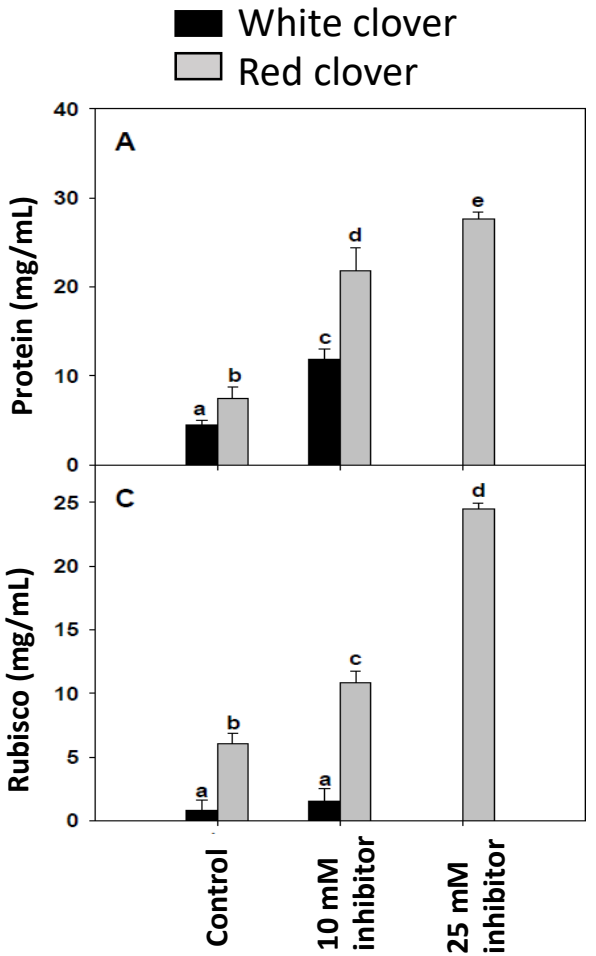


High quality protein for food

- High digestiblity – high nutritional value
- Long shelf life
- Sensory parameters – consumer preference eg. color, taste
- Functionality - texture

Protein gelation





Trine K. Dalsgaard, AU-FOOD

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GREEN BIOREFINERY CAN DISRUPT AGRICULTURE FROM ITS LOCK-IN BECAUSE

- Grass can approx. double productivity while nitrate leaching, pesticide use, GHG emission & soil erosion is reduced
- Extracting the high protein content in grass & legumes while the fibre is fed to dairy cattle creates a new market for grass
- The business case for organic production is positive
- It may be a cheaper way to fulfil e.g. the Water Framework Directive than existing measures often reducing productivity
- Also contributes to the EU climate policy, protein strategy etc.

Demo-plant for green biorefinery now ready to pave the way for market introduction

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

GO-GRASS

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gudp

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Interreg
Öresund-Kattegat-Skagerrak
European Regional Development Fund

EUROPEAN UNION

Green Valleys

BIOBASED INNOVATION STUDENT CHALLENGE, EUROPE (WWW.BISC-E.EU)

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BISC·E
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Welcome on the website of the Biobased Innovation Student Challenge Europe, BISC-E. This challenge gives students the opportunity to explorer the emerging biobased field. A national competition is organized in several countries, followed by a european final for the winners.

GO TO THE DUTCH WEBSITE

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An initiative of TKI-BBE. BISC-E is an initiative of TKI-BBE. The Dutch Top Sectors Agri&Food, Chemistry and Energy join forces in TKI-BBE to replace fossil resources by biomass. TKI-BBE builds, maintains, and executes a knowledge & innovation agenda over all TRL levels. More info about TKI-BBE can be found at (in Dutch only).

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WE CAN RECYCLE ALL RESOURCES ON MARS - WHY NOT DO IT ON EARTH INSTEAD – MUCH CHEAPER!

JONATHAN D. TRENT, NASA & ”THE OMEGA GLOBAL INITIATIVE”

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