

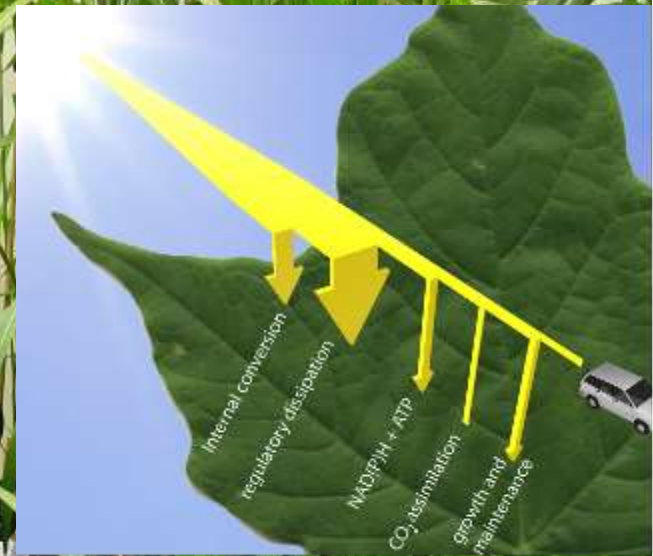
The science behind the potentials of green biorefinery

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

Photosynthesis is *the* foundation for the whole bioeconomy



Gust et al, MRS Bulletin (2008)

However, grain crops are poor "solar panels" seen across a year



Foto: Colourbox

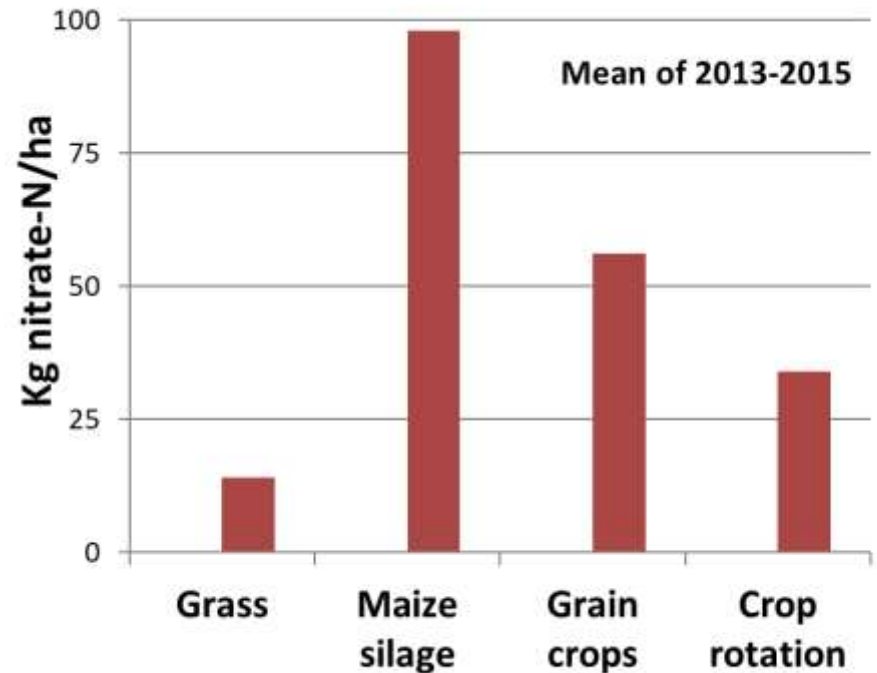
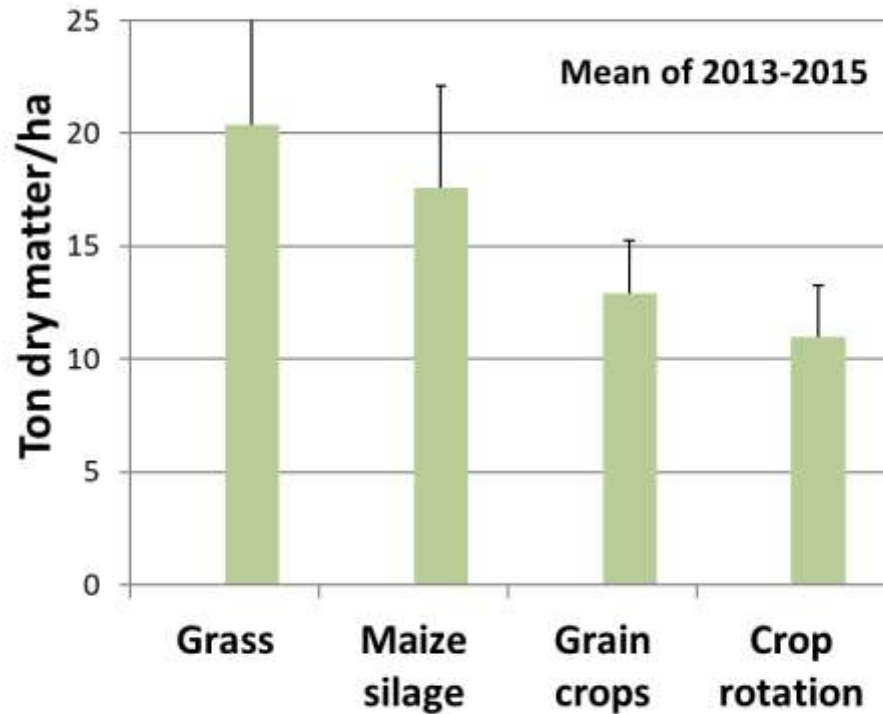


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Field experiments at Aarhus University on the effects of cropping systems



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

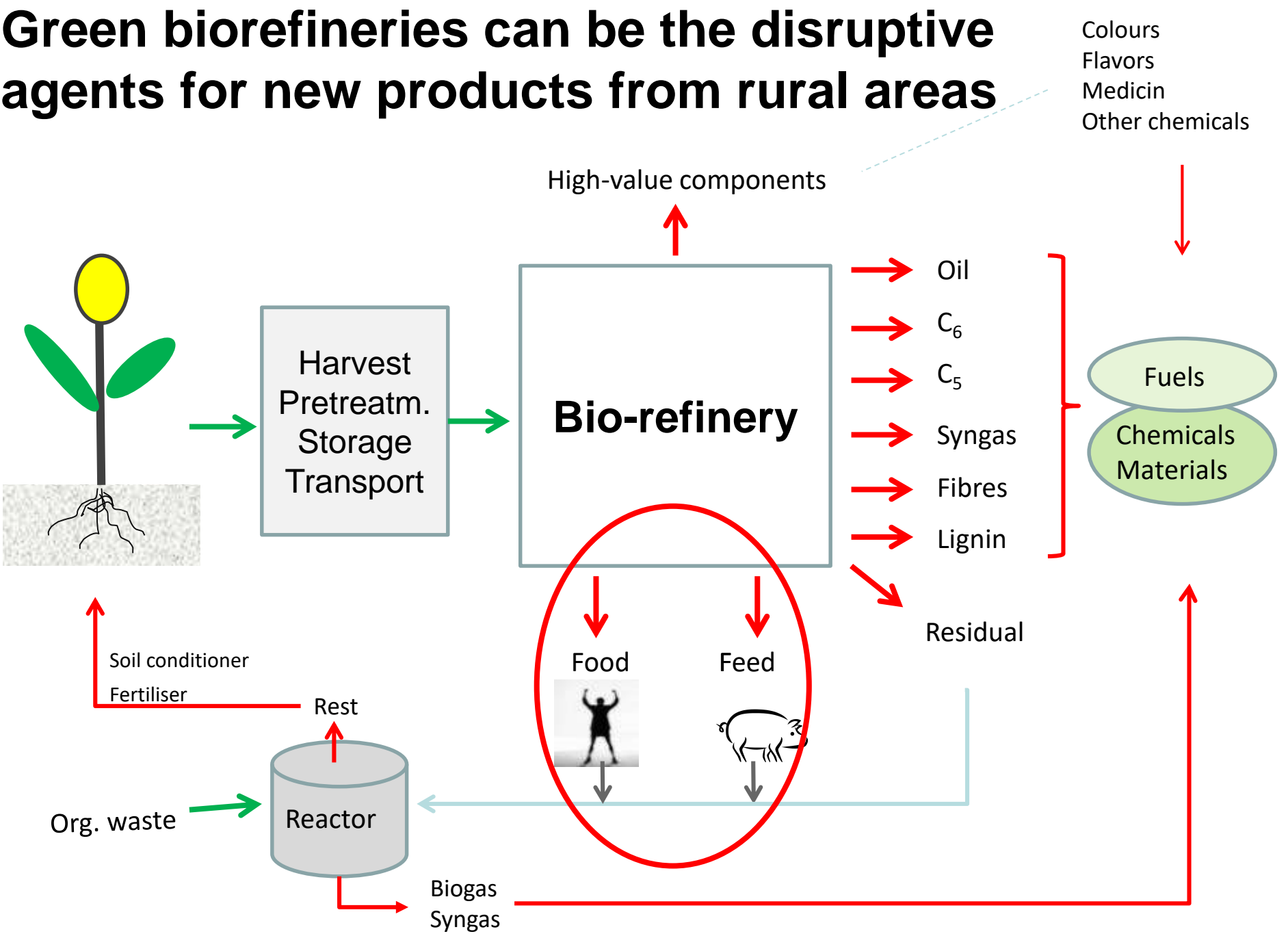
- Reduced soil erosion
- Reduced GHG emission (0.5-3.5 ton CO₂-equiv/ha)
- Reduced pesticide use (by factor 40-50)
- Increased biodiversity



So, what to do with all that grass?



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





Green Valleys
Interreg

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

GO-GRASS



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

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

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

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

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