Camelina and crambe – a blessing for Europe?

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Introduction

The aim of the COSMOS project is to reduce the European oleochemical industry's current dependency on imported vegetable oils (e.g. palm kernel, coconut and castor oil) and fatty acids by establishing camelina (*Camelina sativa* (L.) CRANTZ) and crambe (*Crambe abyssinica* R.E.FR.) as alternative domestic oil crops. Alongside the R&D activities in COSMOS, a comprehensive integrated sustainability assessment is conducted covering environmental, economic and social aspects from a life cycle perspective. This poster's focus lies on the environmental impacts of the investigated systems.

Camelina

Crambe

Methodology

The environmental assessment within the COSMOS project consists of two elements:

– Screening life cycle assessment (LCA)

– Life cycle environmental impact assessment (LC-EIA)

The screening LCA largely follows ISO standards 14040 & 14044 and investigates the environmental impacts of the COSMOS products along the entire life cycle, compared to those of conventional reference products (see Figure 1). Important methodological settings include:

– Ex-ante assessment of scenarios with consequences on a macro-level.

– Representation of industrial-scale and mature technology in 2025.

– A set of midpoint impact categories is covered using ReCiPe methodology.

In addition to global / regional environmental impacts which are well addressed by LCA, local / site-specific impacts are investigated by so called life cycle environmental impact assessment (LC-EIA). Supplementing the classical LCA approach, this method borrows elements from environmental impact assessment (EIA). It involves a qualitative risk assessment regarding potentially affected environmental factors such as soil, biodiversity and landscape (more details are available on our website, see QR code in the footer).

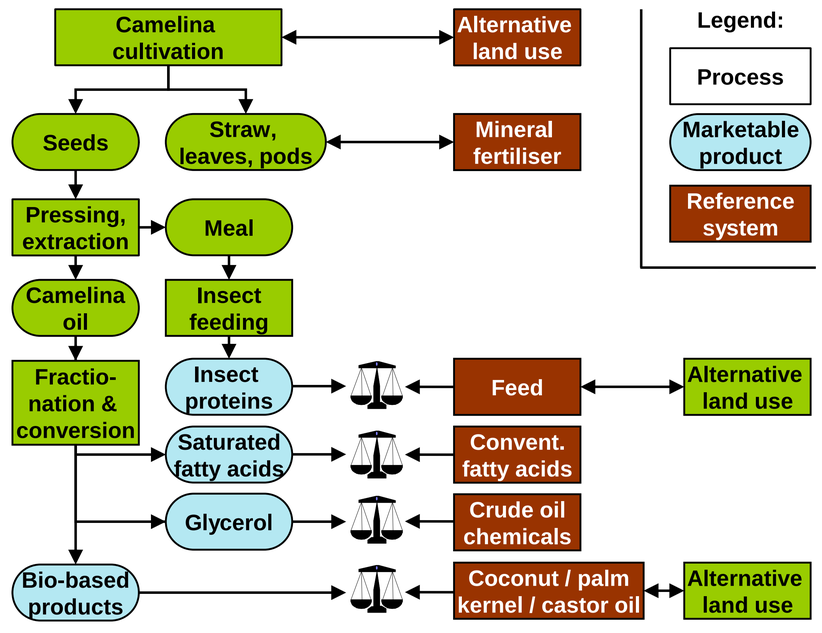

Fig. 1 Simplified exemplary life cycle comparison scheme for various bio-products from camelina cultivation.

Selected results

Tables 1 and 2 Risks associated with the cultivation of camelina compared to rotational fallow land (left) and tropical rainforest compared to cultivation of oil palm (right).

Type of risk	Affected environmental factors								
	Soil	Ground water	Surface water	Plants / Biotopes	Animals	Climate / Air	Land-scape	Human health and recreation	Bio-diversity
Soil erosion	neutral / negative[1]		negative						
Soil compaction	negative	negative		negative	negative				negative
Loss of soil organic matter	neutral / negative[1,2]			neutral / negative[1,2]	neutral / negative[1,2]				neutral / negative[1]
Soil chemistry / fertiliser	negative	negative							
Eutrophi-cation	negative	negative	negative	negative	negative				negative
Nutrient leaching		negative	negative						
Water demand		negative		negative	negative				neutral
Weed control / pesticides		negative	negative	negative	negative				negative
Loss of landscape elements				neutral	neutral	neutral	neutral	neutral	neutral
Loss of habitat types				neutral / negative	negative / positive[2]				negative / positive[2]
Loss of species				neutral / negative	negative / positive[2]				negative / positive[2]

Type of risk	Affected environmental factors								
	Soil	Ground water	Surface water	Plants / Biotopes	Animals	Climate / Air	Land-scape	Human health and recreation	Bio-diversity
Soil erosion	positive		positive						
Soil compaction	positive	positive		positive	positive				positive
Loss of soil organic matter	positive			positive	positive				positive
Soil chemistry / fertiliser	positive	positive	positive						
Nutrient leaching	positive	positive							
Eutrophi-cation	positive	positive	positive	positive	positive				positive
Water demand		positive	positive	positive					positive
Weed control / pesticides		positive	positive	positive	positive				positive
Loss of landscape elements				positive	positive	positive	positive	positive	positive
Loss of habitat types				positive	positive				
Loss of species				positive	positive				positive

1: Negative impact can be minimised in case of double cropping, if used as a starter crop.
2: Negative because of low biodiversity due to monoculture but increased number of blossom visiting insects during flowering period.

Results:

– Cultivation of camelina shows mainly negative local environmental impacts compared to rotational fallow land (Table 1).

– Avoiding land use change from tropical rainforest to oil palms would result in positive local environmental impacts (Table 2).

– Compared to oil palms, camelina shows environmental advantages as well as disadvantages. This holds true for many other comparisons as well.

– Many risks affect several environmental factors.

Conclusions

– The COSMOS project involves the production and replacement of a multitude of different products. Its realisation could cause substantial changes both in the EU and in other world regions, e.g. in Asia.

– Thus, also all conventional reference products which are providing the equivalent functions, need to be investigated as thoroughly as the COSMOS products.

– Special emphasis should be put on the assessment of all involved co-products as well as on the qualitative and quantitative land requirements because these can significantly influence the results.

– For the assessment of environmental impacts, the classical LCA approach – which is limited to regional and global environmental impacts – needs to be supplemented by a separate life cycle environmental impact assessment (LC-EIA) which is addressing local / site-specific impacts.

– Preliminary results show that all vegetable oil-based products are associated with environmental advantages and disadvantages compared to their reference systems.

– Economic and social aspects such as job creation, impacts on indigenous people etc. are important to complete the sustainability assessment.

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Further information:

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