Some Aspects of the Environmental Impact Assessment and Life Cycle Analysis of Kenaf production and use

Ana Luísa Fernando

Faculdade de Ciências e Tecnologia
Universidade Nova de Lisboa
Portugal

⇨ To what extend is cultivation and use of a certain energy crop in a certain European region sustainable?

Environmental Impact Assessment:

Evaluation method to explore the possible environmental effects of a proposed project

Life Cycle Assessment:

Environmental effects of the production of a certain product during the whole life cycle or process chain (from the beginning to the end)

Ecological criteria to be considered

- Energy budget
- Emission of greenhouse gases
- Emission of acidifying gases
- Emission of ozone depleting gases
- Emission of minerals to soil and water
- Emission of pesticides
- Erosion
- Groundwater depletion
- Use of resources
- Waste production and utilization
- Contribution to biodiversity
- Contribution to landscape values
- Other criteria

Socio-economic criteria to be considered

- Costs of energy produced or costs of the product produced
- Costs of abated CO_2 emission
- Employment creation

Net avoided use of fossil energy

Net Energy Gain = **Energy Output** - **Energy Input**

Energy Output

- **Productivity x Heat of Combustion**
  - **When Kenaf is used for energy purposes**
- **Energy needed to produce a substitute of a possible Kenaf product**
  - **When Kenaf is used for other purposes**

Energy Input

- **Production phase**
- **Pre-conversion phase**
- **Conversion phase**

Production phase:

- production of seed and plant-cuttings
- production of chemical fertilizer
- production of pesticides
- production and use of machinery in crop cultivation
- irrigation
- chipping of biomass
- drying and storage of biomass at the farm

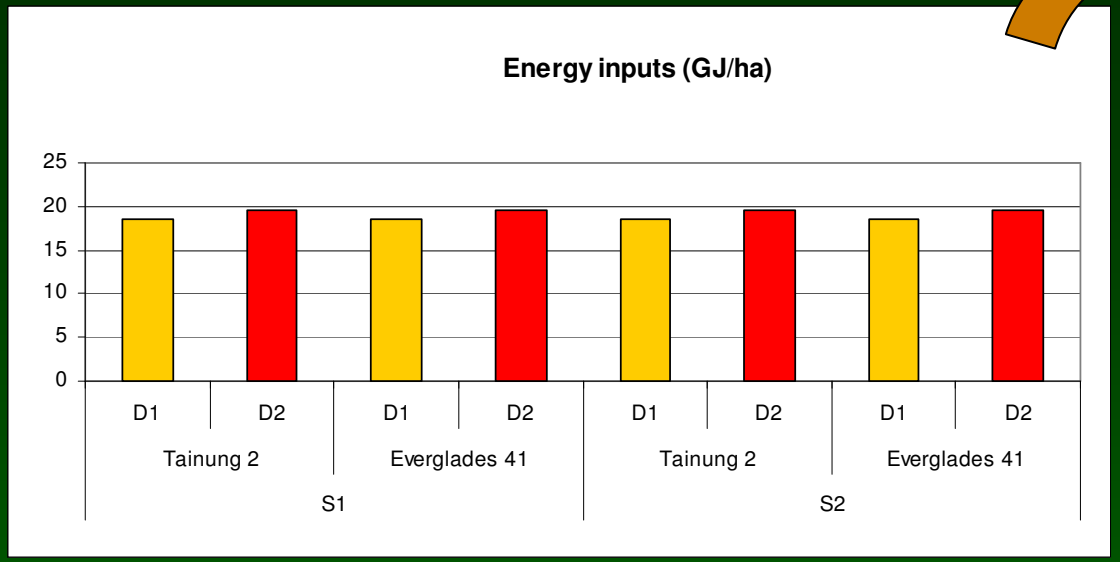
Pre-conversion phase

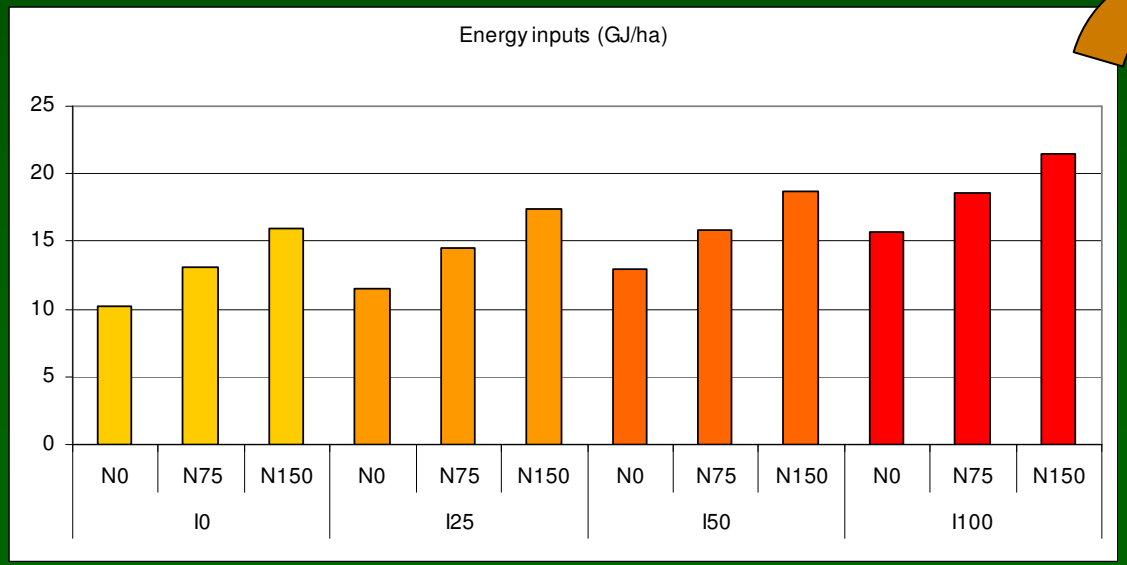
- transport of biomass
- drying and storage of biomass at the plant

Conversion phase

- process energy needed for conversion

Energy inputs – Production phase (Biokenaf project)





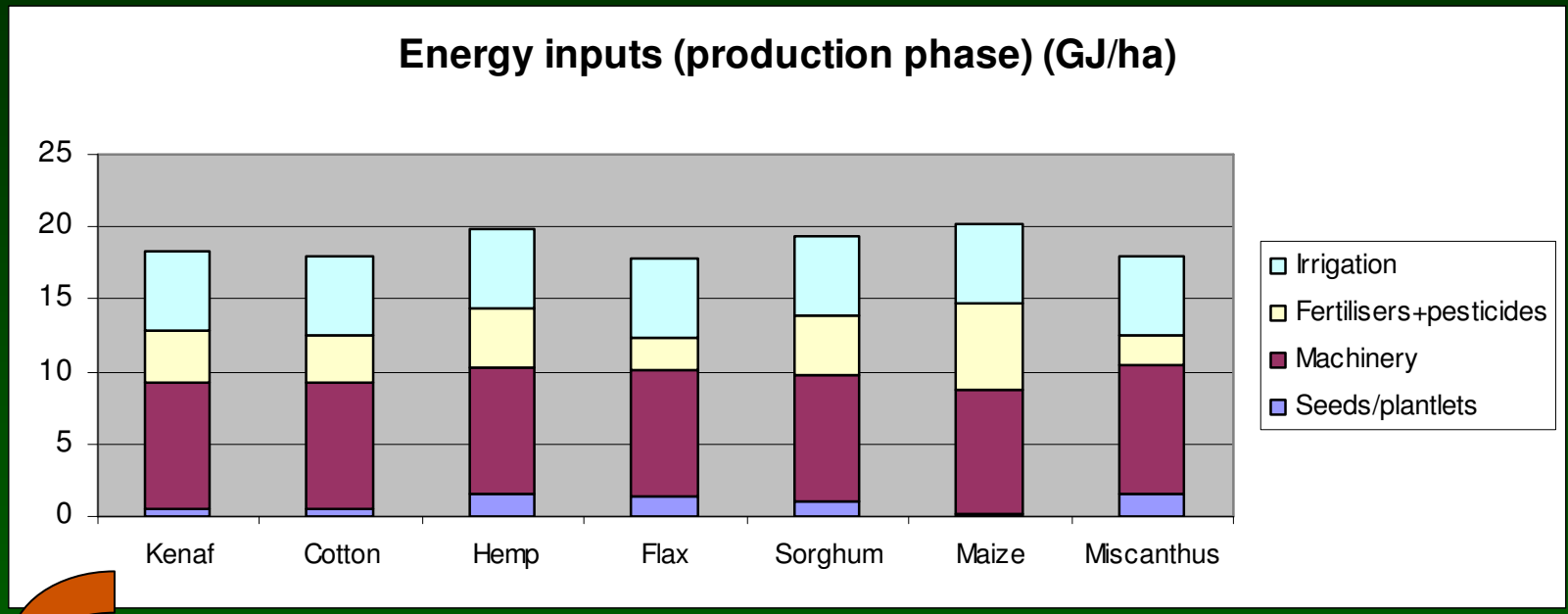
- ⇨ Varieties (no ≠)
- ⇨ Sowing dates (no ≠)
  - ⇨ If Irrigation is the same
- ⇨ Sowing densities
  - ⇨ Higher nºseeds/m²
  - ⇨ Higher E_{input}
- ⇨ $N_{fertiliser}$
  - ⇨ Higher N
  - ⇨ Higher E_{input}
- ⇨ Irrigation level
  - ⇨Higher I
  - ⇨Higher E_{input}

Energy inputs

⇨ Energy inputs will be the same for every country

- ⇨Portugal
- ⇨Greece
- ⇨Spain
- ⇨Italy
- ⇨France

Energy inputs – Comparison with other crops

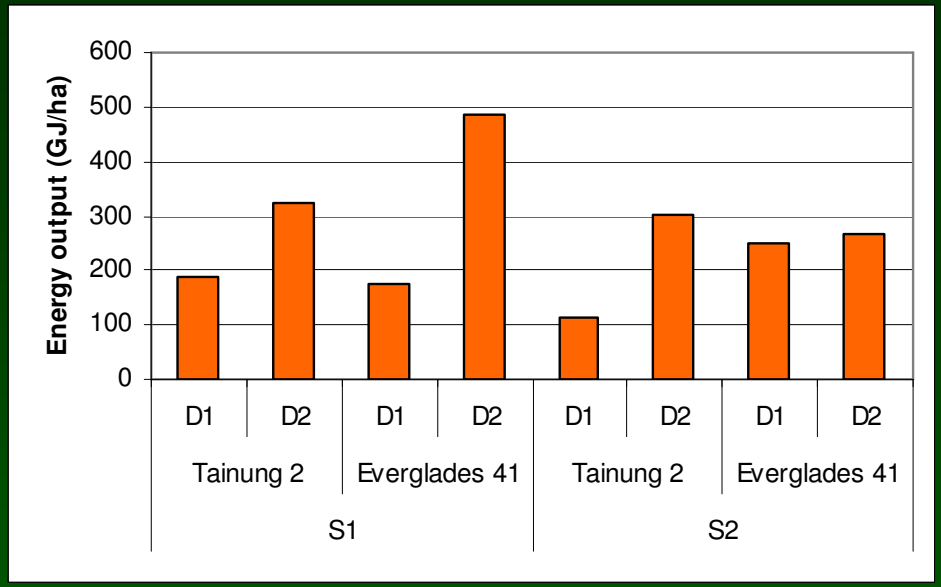


⇨ Hemp and Miscanthus are more costly in terms of seeds/plant cuttings

⇨ No differences among crops in terms of machinery and irrigation

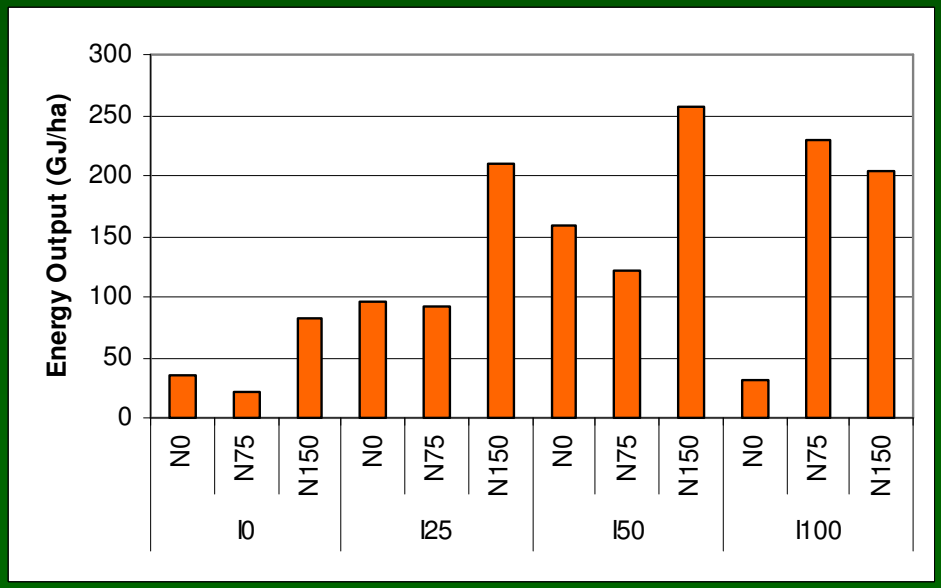
⇨ Maize needs a lot of N fertiliser and cotton a lot of pesticides

Energy outputs – Production phase (Biokenaf project)



The higher the productivity the higher the E_{output}

Early sowing > Late sowing
40 seeds/m² > 20 seeds/m²
Everglades 41 > Tainung 2
(in Portugal)



I0 < I25 < I50 < I100

N0 = N75 < N150 kg/ha

(In Portugal)

Energy outputs – Production phase (Biokenaf project)

Comparison among Biokenaf partners

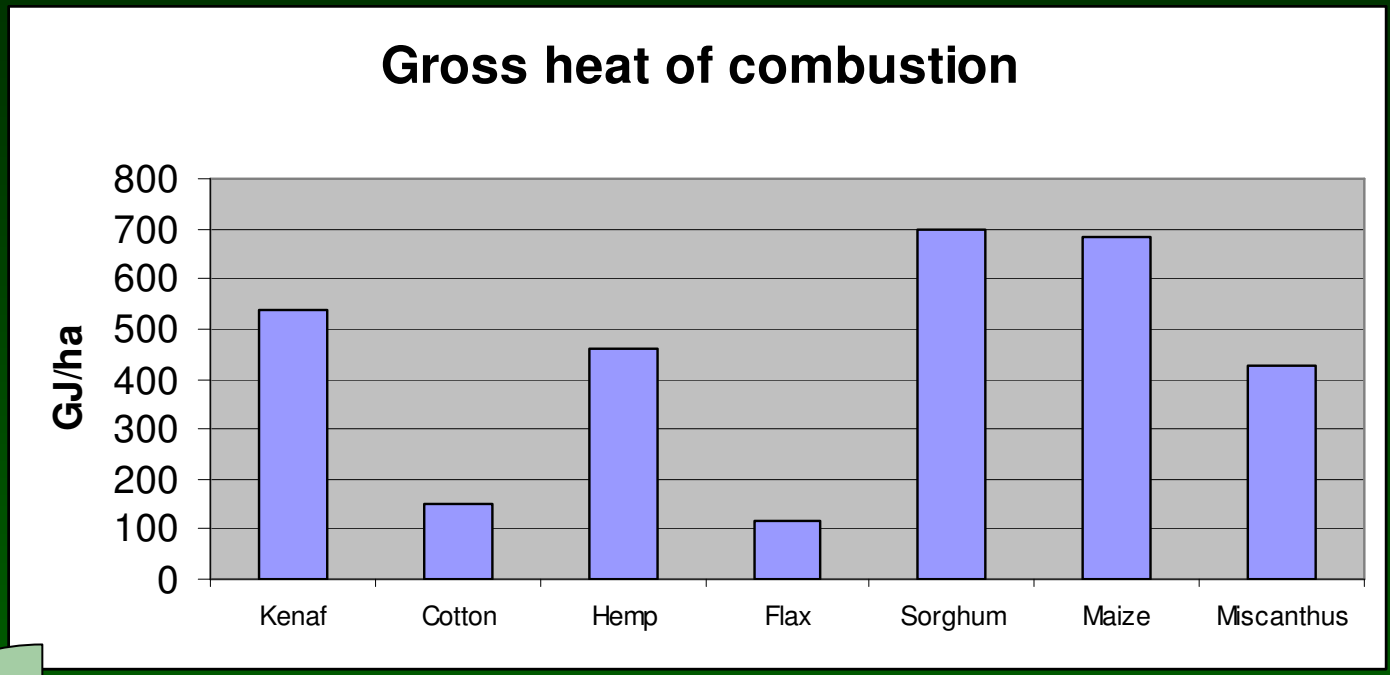
The higher the productivity

the higher the Eoutput

Results obtained by partners
are attainable results

2 ha fields are actual results

Energy outputs – Comparison with other crops



The more productive is the crop the more E_{output}

Emission of Greenhouse Gases

Emission of acidifying Gases

Emission of ozone depleting gases

Emission of Minerals to Soil and Water

Emission of pesticides

Calculated for each partner
with the results obtained in the fields
and
with data concerning crop management

Soil Erosion

→ Soil covered by leaves, stems and roots -
- division of the crop growth into stages

→ Rainfall

Harmful Rainfall

- with data from partners and for each location

Groundwater depletion

- water use of the crop during its growth
- additional water use caused by irrigation

Data will be calculated for each location according to data obtained from partners

Use of Resources

Information collected concerning

- exhaustion of fossil energy
- exhaustion of fertilizer ores (K and P)

Data from partners will be necessary

fertilisers, etc

Waste production and utilization

- possible uptake of contaminants

- possible formation of ashes and if they are dumped, particularly when considering the gasification or combustion conversion processes

- reuse of residual materials

- Contribution to biodiversity

- Contribution to landscape values

should also be considered

Socio-economic criteria to be considered

- Costs of energy produced or costs of the product produced
- Costs of abated CO_2 emission
  - Calculated from data obtained from energy budget and emission of greenhouse gases
- Employment creation
  - It will be considered for each location
  - Data will be necessary from each partner