Exploring the potential of reed as a biofuel crop in the Netherlands

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Outline

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Introduction

- EU Directive on Renewable Energy targets by 2020:
  - 20% of total energy consumption
  - 10% of total transport fuel consumption

- Reed as a bioenergy crop:
  - Combustion for district heating and electricity generation
  - Biogas (co-digestion with manure)
  - Bioethanol (2nd generation biofuel)
Potential for reed in the Netherlands?

- Indigenous in the Netherlands
- Grows well in wet areas
  - Salt tolerance
  - Suitable for peat soils
- Bioenergy crops are generally low-value products best grown on a large scale
- However, the Netherlands is a densely populated country with high pressure on land and an advanced agricultural sector specialized in high-value crops
Spatial exploration

- simulation of local competition for land according to economic performance

![Flowchart showing biophysical factors, land use, economic factors, and non-spatial factors connected to future land-use with specific examples of soil type, current land-use, infrastructure and accessibility, and factors like available technological options, production costs, crop market prices, and discount rate.](Image)
Economics of reed as bioenergy crop

- Yield (dry biomass): 15 t.ha⁻¹.yr⁻¹ without fertilizer
- Gross revenues (€.ha⁻¹.yr⁻¹):
  - Ethanol 1,151
  - Combustion 475
  - Biogas 625
- Total production costs (€.ha⁻¹.yr⁻¹)
  - Ethanol 2,387
  - Combustion 1,285
  - Biogas 1,900
Reed as a multifunctional land-use

- Water buffering
  - Integrated water management – water storage during floods and dry periods
- Surface water purification
  - Absorption of nitrates and phosphates
- Carbon sequestration above and below ground
- Avoids peat oxidation
  - Subsidence
  - CO$_2$ emission (loss of organic matter)
  - Risk of saline seepage
Peat soils in the Netherlands
Economics of multi-functional reed cultivation

- Additional benefits (€.ha$^{-1}$.yr$^{-1}$, based in previous cost-benefit analysis):
  - Water storage (where applicable): 400
  - Water purification: 400
  - Net effect on GHG emissions: 245
  - Net effect on GHG emissions in peat soils: 271
Scenarios for 2030

Based on a previous study for EC’s DG-ENV

1. Reference: IPCC B1
   - Ongoing policies, incl. liberalization of agricultural trade
2. High oil prices and strong climate change
3. Biofuel policies
   - Promotion of biofuels in EU and rest of the world
4. Soil protection and climate mitigation policies
   - Increased promotion of water buffering and sustainable use of peat soils
Results

Scenario 1: IPCC B1

Scenario 2: High oil prices & climate change
Results

Scenario 3: Biofuel policy

Scenario 4: Soil protection and climate change adaptation
Conclusions

- Reed cultivation for energy purposes not economically viable in the Netherlands under current conditions
- Only attractive if benefits from additional functions are also taken into account
  - Particularly in peat soils
- Future developments in terms of energy prices, climate change and policies may make reed more economically attractive
  - Combination of biofuel policies with environmental measures
Conclusions

- Two systems of reed cultivation could be envisaged:
  1) Large-scale dedicated cultivation of reed in specialized farms
     - However, landscape issues should be taken into account
  2) Combination of livestock production and reed cultivation
     - Small-scale production of biogas through co-digestion of reed and manure
Thank you