

Application of sustainability criteria to sugar beet for ethanol production in the Netherlands

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Introduction

Biofuels play an important role in policies for greenhouse gas (GHG) emission reduction and a more secure fuel supply. Considerable increases of biofuel production can be realized; large scale biomass for biofuel production can however compete with food or feed production or threaten biodiversity. It is not easy to evaluate sustainability claims made by biofuel producers or the accusations made by their critics. A neutral set of criteria is needed to assess the (un)desirable impacts of biofuel production. In the Netherlands, the Cramer Commission has produced a set of sustainability criteria⁵. They cover six themes: GHG emission reduction; competition with food and local use of biomass; impact on biodiversity; impact on environment; impact on local incomes and impact on local well-being (Table 1).

Table 1. Cramer Commission criteria

Sustainability theme	Principle	Example of criterion
Greenhouse gas emission reduction	GHG balance of the production chain should be positive, carbon stocks in soil and vegetation must be preserved.	Production chains must reduce GHG with at least 30% compared to fossil fuels. No depletion of carbon stocks.
Competition for natural resources	Production of biomass for fuel does not compete with food production or local biomass use.	Assessment of changes in land use, land and food prices is required.
Biodiversity	Biomass production must have no negative impact on protected or endangered biodiversity; where possible biodiversity is strengthened.	No biomass production allowed in protected areas. Production must have no negative impact on 'high conservation' areas.
Environment	Soil and soil quality are maintained or improved. Groundwater and surface water are not depleted; water and air quality are maintained or improved.	Water use is restricted to renewable water. 'Best practices' should be applied to conserve soil quality and prevent air pollution.
Prosperity	Biomass production must contribute to local prosperity.	Production must have a positive impact on the local economy.
Social well-being	Biomass production contributes to well-being of workers and the local society.	Production must have no negative impact on labour conditions or human rights.

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Methodology

The criteria defined by the Cramer Commission were applied to production of bioethanol from sugar beet in the Netherlands⁶. Production data for sugar beet for 2005, 2006 and 2007 were provided by two experimental farms, one on a sandy soil (Valthermond) and one on a clay soil (Westmaas). Both have sugar beet in the standard crop rotation, which is representative for the region where the farms are located: the 'Veenkoloniën' in the Northeast (Valthermond) and the young marine clay areas of the Southwest (Westmaas) of the Netherlands.

Results

Production of sugar beet ethanol helps to reduce GHG emissions by 55 to 67% (Table 2), well above the required 30%. The energy balance is positive; average net energy production is 79 GJ per ha. Increased beet for ethanol cultivation would come at the expense of maize (Westmaas) or barley (Valthermond). This does not likely affect food or land prices, or biodiversity. The impact on soil organic matter is negligible, and the general impact on soil and water quality is limited or positive. Prosperity and social well-being are not negatively affected.

Table 2. GHG emission reduction of sugar beet ethanol compared to petrol

Location	Year	GHG emission reduction (%)
Westmaas	2005	65 - 67
	2006	61 - 64
	2007	58 - 62
	Average	61 - 64
Valthermond	2005	55 - 58
	2006	59 - 63
	2007	62 - 65
	Average	59 - 62

Discussion and conclusion

Application of the Cramer criteria suggests that beet ethanol production in the Netherlands will have a positive impact. GHG emissions will be reduced significantly. This will not negatively affect biodiversity, or soil and water quality. Further, no negative impact is expected on local prosperity or well-being, but changes in cultivated area of other crops, (silage maize in Westmaas, barley in Valthermond) will have to be compensated. This may limit the high GHG emissions which is however not expected to drop below the required minimum level (30%). Overall, criteria presented by the Cramer commission allow for an effective, balanced and neutral evaluation of biofuel production chains.

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References

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