Report on the calculation of emissions caused by the cultivation of crops for the production of biofuels

Belgium – Flemish Government

March 2010

Department for Agriculture and Fisheries, Monitoring and Studies department, Sustainable Agricultural Development department

Veerle Campens, Koen Holmstock

Vlaamse overheid

Report on the calculation of emissions caused by the cultivation of crops for the production of biofuels Belgium – Flemish Government

Veerle Campens, Koen Holmstock

Vlaamse overheid

Department for Agriculture and Fisheries,
Monitoring and Studies Department,
Ellipse building (6th floor) Koning Albert II
- laan 35, PO box 40 1030 Brussels
Tel. 02 552 78 24 - Fax 02 552 78 21
e-mail: ams@vlaanderen.be

Campens V., Holmstock K. (2010) Report on the calculation of emissions caused by the cultivation of crops for the production of biofuels, Agriculture and Fisheries policy, Monitoring and Studies Department, Brussels.

We do our best to ensure that all information, web pages and downloadable documents are as accessible as possible for everyone. However, if you experience difficulties consulting particular data, we are happy to assist you. You can contact us at any time.

Contents

Contents
List of abbreviations
1. Introduction……..4
2. Methodology……4
2.1 Crops……4
2.2 Data……4
2.3 Calculation Method……...5
3 . Results……..6

List of abbreviations

AMS	Monitoring and Studies Department
FADN	Farm Accountancy Data Network
ILB	Farm Accountancy Data Network (FADN)
FSS	Farm Structure Survey
NUTS:	Nomenclature of Territorial Units for Statistics
kg	kilogram
ha	Hectare
LMN	Agricultural Monitoring Network

1 Introduction

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC lays down sustainability criteria for biofuels and bioliquids. One of these criteria is calculating a CO2 emission saving for the biofuels from the time the bioliquids are produced until they are in the tank *(Article 17(2))*.

For the typical greenhouse gas emissions caused by the production of agricultural raw materials (the first link in the chain), the Member States must inform the Commission by 31 March 2010 at the latest *(Article 19(2))* of the areas (max NUTS2 or province) where the typical greenhouse gas emissions caused by the production of agricultural raw materials are lower than the disaggregated default values in part D or E of Annex V to the Directive. The Member States must also submit a description of the method and data that they have used. The method used to calculate these emissions must take into account soil characteristics, the climate and anticipated yield of raw materials.

However, if it can be demonstrated that these typical greenhouse gas emissions caused by the production of agricultural raw materials are lower than or equivalent to the disaggregated default values, the default values or disaggregated default values given in Annex V can be used for the whole chain *(Article 19(3)(b)*. This greatly simplifies administrative procedures for the producers of biofuels.

This report contains a description of the method and data used by the Flemish Government in order to comply with the above articles of the Directive.

2 Methodology

2.1 Crops

The crops for which the greenhouse gas emissions are calculated are (part D or E of Annex V):

- Wheat for bioethanol
- Sugar beet for bioethanol
- Corn for bioethanol
- Rape seed for biodiesel and for pure vegetable oil.

2.2 Data

Where possible data is used which is official and which the EC can audit.

For the yield figures per hectare the NIS data is used. This data forms the basis for the European Farm Structure Survey (FSS) and it is compulsory for it to be reported annually to the EC.

For the quantities of chemical fertiliser (N, P205, K20), crop preservatives (active substances) and seed data from the Agricultural Monitoring Network (LMN) is used. The LMN is organised by the Monitoring and Studies Department (AMS) which is part of the Department for Agriculture and Fisheries of the Flemish Government. Amongst other things, the LMN supplies accounting information to the Farm Accountancy Data Network. The latter was formed on account of the obligation for European Member States to collect farm data. Approximately 760 Flemish farms and horticultural holdings in different sectors participate in the LMN. They provide their farm data for the administration. If there is insufficient data (< 6 ha) for a specific crop in a specific NUTS2 region, the average for Flanders is taken. For certain data about rape seed the LMN is not representative and an expert from the Department of Agriculture and Fisheries was consulted.

The data used from the LMN and the NIS are averages for 2005-2008. As the data for chemical fertiliser for 2008 was not yet available, for chemical fertiliser an average from 2005-2007 was taken. By taking averages a really good or a really bad year carries less weight. Levels of phosphate poisoning via chemical fertiliser are low in Flanders as it already has much phosphate-saturated ground and more phosphate there is applied via animal manure.

Concerning the use of fossil fuels a recent Flemish study was used which calculates the use of fuels for agricultural activities per hectare, taking into account, amongst other things, the crop, the class of soil and the size of plot in accordance with Schrooten *et al.* (2009)[1]

The N2O emissions used are arrived at using the DNDC method, as shown on the JRC Excel sheet. This method, based on European data, calculated for example for wheat an emission of 0.024g N2O/MJ wheat.

The co-efficients for Global Warming Potential (GWP) and for the net calorific value (LHV)of fuels can be found in the Directive. For the net calorific values (LHV) of the crops and of some of the by-products the German study by Fehrenbach *et al* (2007) was consulted.[2] The co-efficients for greenhouse gas emissions (GES) expressed in g CO2-equ per kg or per MJ or in MJf/kg come from JEC 2007, as they were not updated in 2008. The other sources were taken from the JRC. For each set of data the source is only given in the last column of the table 'Data for Flanders'.

2.3 Calculation method

As Europe does not provide any detailed method of calculation, we attempted to copy the method used by the JRC, which was developed in the 'Well to Wheel' study and can be found on the Internet at: http://ies.jrc.ec.europa.eu/WTW. This method takes into account:

- The crop yield
- Emissions caused by the use of fossil fuels in agricultural activities
- Emissions caused by the production of N chemical fertiliser, used for the crop
- Emissions caused by the production of P205 chemical fertiliser, used for the crop
- Emissions caused by the production of K2O chemical fertiliser, used for the crop
- Emissions caused by the production of crop preservatives, used for the crop
- Emissions caused by the production of seed, used for the crop
- Emissions of N20 from the soil.

[1] Schrooten L., Jespers K., Baetens K., Van Exch L., Gijsbers M., Van Linden V., Demeyer P. (2009) OFFREM. Model voor emissies door niet voor de weg bestemde mobiele machines. Studie iov Dept. LNE, België.

[2] Fehrenbach H., Giegrich J., Gärtner S., Reinhardt G., Rettenmaier N. (2007) Greenhouse Gas Balances for the German Biofuels Quota Legislation, Methodological Guidance and Default Values. Prepared for the Federal Environment Agency Germany, Heidelberg, Germany.

This is the method that the European Commission would have used for establishing the typical greenhouse gas emissions given in the Directive. It is therefore very interesting to use the same method to calculate own values and then to compare them with the default values used in the Directive. The JRC Excel sheet containing the calculations is given in the Annex.

G:Cel Study\
Projects\2010 *RED* •

We also chose to express everything relating to the crops in terms of quantity of dry matter instead of a moisture content of, for example, 10%.

Regarding by-products, the CO2 emissions were distributed in accordance with the energy content of the by-products and the biofuel.

- DDGS is a by-product of wheat.
- For sugar beet the by-product is beet pulp.
- For corn the by-product is DDGS.
- For rape seed for biodiesel the by-products are rape seed grist/flakes.
- For rape seed for PPO the by-product is rape seed cake.

3. Results

	(gCO2/MJ etoh)	Wheat (grain)	Sweet beetroot	Corn for ethanol (grain)	Rape for biodiesel	Rape for PPO
NUTS2	Antwerp	4.4	7.5	7.0	9.7	20.8
	Brabant	5.6	8.3	7.3	20.3	21.4
	West-Flanders	5.6	8.4	7.3	8.9	19.9
	East-Flanders	5.7	8.7	7.2	22.6	23.9
	Limburg	4.7	8.5	7.2	20.0	21.0
Region	Flanders	15.3	8.6	7.2	19.9	20.9
	Limit in Directive	23	12	20	29	30

The detailed calculations may be found in the following Excel sheet:

G:Cel Study\
Projects\2010 *RED* •