copa cogeca

european farmers european agri-cooperatives

SRD/	DG: E
A/	
ACTION:	ÉCHÉANCE:
CODE DOSSIER:	

060312

A	B	C	D	E
DG	~~AGS~~	001	01	SIAC
DGA	DGA	DGA		
DBC	DCDE	DDE		

BI(12)1576:1

Mr. Philip LOWE
Director-General for Energy
European Commission
200 rue de la Loi
B-1040 Brussels

Brussels, 2nd March 2012

Re: Biofuels - iLUC factors based on the IFPRI report

Dear Sir,

According to our information, the European Commission are currently discussing, amongst other matters, the inclusion of iLUC values in the greenhouse gas balance of biofuels. The report **"Assessing the Land Use Change Consequences of European Biofuel Policies"** published by the International Food Policy Research Institute (IFPRI) in October 2011 is apparently being used as a basis for this discussion. An overview of the uncertainties and errors in the MIRAGE-BioF model, some of which were identified by the author himself, is provided in attachment.

1. **LUC values**

   According to the author, Mr Laborde, the model is not suitable for precisely estimating the extent of land use change and the resulting greenhouse gas emissions, due to data uncertainties.

   Providing precise LUC values in the report (table 14, p. 59) directly contradicts the author's proviso.

2. **Prohibited land use change**

   The fundamental basis of the model ignores measures taken by governments to prevent land use change. Protection measures stipulated in Directive 2009/28 such as bans on direct land use change are not taken into account. The result is that the model erroneously assumes that biofuels prohibited by Article 17 paras. 3 and 4 Directive 2009/28 that were produced from raw materials stemming from land such as primary forest, peatland, etc. are in fact accepted within the EU framework. The reason for this is that the model is unable to distinguish between direct and indirect land use change. As a result, the model estimates, for example, that approx. 70% of greenhouse gas emissions caused by land use change will come from the production of raw materials originating from peatland, forests and rainforests. Government measures that work to counteract direct and indirect land use change are also disregarded with no distinction. These are, however, extremely important. In Brazil, for example, the "Amazon Region Protected Areas (ARPA)" programme[1] brought about a decline in rainforest clearance by 75% from 28,000 km² in 2004 to 7,000 km² in 2010. The effect for the model is particularly critical because by far the greatest case of land use change is projected for Brazil (0.49 million ha), despite it being largely prohibited there. Future government protection measures are also ignored. Even if these measures cannot be projected with certainty, completely ruling them out is problematic. It must be assumed that measures undertaken by governments to protect land will give priority to land with particularly high carbon stocks, thus preventing high greenhouse gas emissions. Overall, it must be assumed that up to approx. 70% of the projected greenhouse gas

[1] www.wwf.de

Copa - Cogeca | European Farmers European Agri-Cooperatives
61, Rue de Trèves | B - 1040 Bruxelles | www.copa-cogeca.eu
EU Transparency Register Number | Copa 44856881231-49 | Cogeca 09586631237-74

emissions would be eliminated if government protection measures were taken into account. The model is therefore so flawed that not only is it not possible to predict quantities, a qualitative forecast, i.e. whether land use change is anticipated and, if so, which land use change as well as the resulting greenhouse gas emissions, would also be meaningless.

3. Data errors

A particularly notable example of the use of inaccurate data in the model is the global cropland basis. For the 2008 baseline scenario, apparently modified results from a simulation by the MIRAGE-BioF model were used instead of the FAO's data for that year (1.53 billion ha). The supposed value of 1.12 billion ha is not the result of the studies cited in this respect by the author and others. This would suggest that approx. 410 million ha of cropland has not been taken into account. This represents a data error of 27%.

4. Review

The author of the IFPRI report rejected validation of the model by independent experts at a hearing organised on this issue by the Commission on 18th November 2011. In our opinion, this violates the basic rules of good scientific practice. Performing an external review of the model for its suitability to forecast land use change by applying it to a historic time period (for example, 2000 to 2010) where actual land use change is known is absolutely essential. These types of evaluations are, for example, a scientific standard of the IPCC.

To sum up, the number and significance of the uncertainties are so critical that the model is not suitable for assessing the impact of indirect land use change in accordance with Article 19 para. 6 of Directive 2009/28.

Copa-Cogeca rejects this report being used as the basis for a proposal, in view of Article 19 para. 6 of Directive 2009/28. The assumptions and data that the MIRAGE-BioF model is based on are so flawed that the model is unsuitable for forecasting greenhouse gas emissions brought about by land use change. If the IFPRI report is used as a basis, the iLUC values introduced into law on the greenhouse gas balance of biofuels would be arbitrary, given that the MIRAGE-BioF is not in a position to forecast land use change and the associated greenhouse gas emissions.

We hope these comments will be granted your full consideration.

Yours faithfully,

[redacted]

[redacted]
Secretary General

CC: [redacted]

Annex : BI(12)1585

Analysis of the IFPRI report

Results of the analysis

The MIRAGE-BioF model used as a basis for the IFPRI report contains errors that are so numerous and critical that neither a quantitative nor a qualitative forecast is possible, i.e. whether land use change is anticipated and, if so, what kind as well as the resulting greenhouse gas emissions.

"However, we also emphasize the critical uncertainties that prevent us from being able to provide a precise two-digit figure on the extent of land use change and associated emissions."
Laborde et al. (2011)

The overview below contains a detailed list of "uncertainties" identified by the author as well as other errors and incorrect assumptions.

Outline of the analysis

1 to 6	**Basic problems**	Page 1
7 to 33	Uncertainties: 27 significant unreliable estimates	Pages 1 to 7
34 to 41	Data errors: 8 critical data errors	Page 8
42 to 47	Assumptions: 6 impermissible model assumptions	Pages 9 to 10
	Sources	Page 10

1.Basic problems

	IFPRI	Analysis	Error
1.	Transparency and reproducibility of MIRAGE-BioF	It is not possible for independent experts to validate the model calculations of the MIRAGE-BioF model.	Violation of the principles of scientific practice[1]
2.	Absence of peer review	The quality of the model has not been evaluated by other scientists to date.	
3.	An evaluation/validation of the IFPRI model was refused by Mr Laborde.	Evaluation/validation: check of estimates for a historical period using real data	
4.	No distinction made between iLUC and dLUC. *"We do not distinguish between indirect or direct effects."*	Is not capable of forecasting indirect land use change	Emissions overestimated by up to 70% (p.21, figure 11 p.54)
5.	Land use change prohibited by governments is ignored. *"It should be borne in mind that these results are obtained without any explicit modelling of the impact of the sustainability criteria in the RED ..."*	Nature conservation laws and, e.g. the European sustainability criteria, are not taken into account in the study.	Biofuels produced from raw materials from "no go areas" are accepted in the model (p.13).
6.	The promotion of the use of degraded land is not taken into account in the model.	Violation of Directive 2009/28/EC	Bonus for crops grown on degraded land is counteracted.

2. "Uncertainties" according to IFPRI

	Pages 24 to 27	Relevance	Effects on the results
	I. Uncertainties in relation to the additionally needed land		
7.	Crops in the baseline scenario Biofuel yields per unit of feedstock	High	Results for crop yields (p.35,56) and biofuel production by feedstock (p.42,69).

[1] http://www.leibniz-gemeinschaft.de "Sicherstellen der Reproduzierbarkeit vor der Veröffentlichung (Kriterien der Wiederholbarkeit und Nachvollziehbarkeit) ebenso wie die Schaffung von Zugangsmöglichkeiten für berechtigte Dritte." ("Ensuring the Reproducibility Prior to Publication (Criteria of Reproducibility and Traceability) as well as the Creation of Access Possibilities for Authorized Third Parties."

2. "Uncertainties" according to IFPRI			Effects on the results
	"Crop yields in the baseline, biofuel yields per unit of feedstock. The higher the yield, the smaller the LUC. They depend on technology, which in the medium / long term depends on expected profitability. They can also be impacted by exogenous conditions (climate change...);"		
8.	Crop yield response in the scenarios *"Crop yield response in the scenarios. The more yields react to crop price increases, the smaller the LUC. It depends on the price sensitivity of farm decisions (e.g. fertilizer, reduction in waste);"*	High	Results for crop yields in the baseline scenario (p.35) and worldwide production (p.40,43).
9.	Crop yield on new cropland *"Yield on new land. When crops expand into new land, yield depends on the quality of the new land, previous uses of that land and availability of services such as irrigation for the new area;"*	High	Global production (see p.40).
10.	Supply response of farm inputs such as fertilizer *"The supply response of farm inputs such as fertilizer. The less elastic the supply of farm inputs, the less elastic the crop supply. Effects on LUC can go either way."*		Results for intensification and land use change (p.55,68).
11.	Demand response for raw materials *"The demand response for all the crops. If the price of crops increases, how will consumers react? How do intermediate sectors modify their demand for inputs? Do they substitute some inputs by others (e.g. cotton replaced by synthetic fibers, farm fishing using biofuels co-products like DDGS instead of other animal based meals?)? The more elastic the supply, the more limited the LUC."*	High	Results for demand (p.66-67).
12.	Degree of substitution among oil products (in particular the effects of peatland emissions) *"A particular issue is the degree of substitution among vegetable oils. To what extent can rapeseed, sunflower, soybean and palm oil be substituted in the demand of different agents (households, industrial demand, biofuel production)? The higher the substitution, the larger the peatland effect – a large source of carbon emissions – for all biodiesel feedstocks."*	High	Effects on the respective CO2 balance of biofuels (p.54,63) degree of substitution in the study results in major "leakage effects" (p.66-67,71).
13.	Livestock sector response: effects of the co- and by-products/feed composition/demand for meat *"The livestock sector. It is important to single out livestock sector behavior due*	High	Results for feed prices (p.45,100) and degree of substitution for feed (p.64).

2. "Uncertainties" according to IFPRI			Effects on the results
	to the role of co- and by-products of biofuels as feed for livestock. Could livestock production intensify? How flexible is the composition of the feed ration? And ultimately, how will this affect demand for meat?"		
14.	Economic triggers of land use change: 1. Option between different raw materials 2. Expansion of cropland *"Price sensitivity of land allocation decisions, i.e. the land elasticities in the model. It has two dimensions. First, can farmers re-allocate their land among different agricultural uses? It depends on the way prices will affect cropping decision under a set of technical (soil quality, needs for crop rotation) and behavioral (risk aversion of farmers and needs to keep a diversified portfolio of products) constraints. Second, the potential scope for farmers/ranchers to extend their agricultural land in new areas has a direct bearing on the LUC effect. If land extension is not possible due to the lack of suitable land, the high cost of accessing the new land (transport cost), the high cost of putting this new land into cultivation (needs of irrigation etc.), than land extension will be limited and biofuel demand will lead to higher agricultural prices and more constraints on the demand components, as well as more incentives for intensification;"*	High	Results (p.95-96).
15.	Globalisation: impact on international competition *"How do business networks operate and to what extent is the supply chain exposed to international competition? It defines the possibility of importing foreign inputs. The LUC consequences depend on the extent to which trade facilitates the relocation of production from low to high yield regions, or the reverse;"*		Impact on model is not transparent. (see item 1)
16.	Relationship between global biofuel production and the price of crude oil *"The global level of biofuel production and the level of oil prices. In the case of high oil prices, many countries can have profitable biofuel production at market prices (even without mandates). In this context, a stronger demand in Europe, driven by policy, will increase the price of biofuels, attract foreign production and at the same time deter foreign consumption (for the share not constrained by foreign mandates). In this case, EU demand does not necessarily lead to an increase in production of biofuels but just a reallocation of consumption at the world level, leading to minimized LUC effects;"*	High	Assumptions about the oil price (p.36,37) and development of the oil price (p.57).

2. "Uncertainties" according to IFPRI			Effects on the results
17.	Macroeconomic factors such as exchange rates, direct investments, etc. *"Macroeconomic conditions such as exchange rate, foreign direct investments, etc. For instance, if macroeconomic conditions leads to a strong real appreciation of the Brazilian currency compared to the US dollar, US ethanol is more competitive than Brazilian and EU demand patterns, both in the baseline and in the scenario, will be different, as well as the global land use pattern (even for non biofuel crops). If macroeconomic conditions favor farm expansion in regions with high yields and/or strong land market governance, the LUC effect will be reduced;"*		Assumptions and results of prices (p.36, 101-102).
18.	Effects of economic development: future demand for agricultural products and land *"Economic growth in the baseline and its consequences for the demand of agricultural products, for food and non food, and for land (urbanization). It affects the amount and quality of land when the policy shock is introduced. If land availability has been reduced, the LUC effect will be reduced, but if high quality land availability has been reduced first, it decreases marginal yield and leads to stronger LUC."*		Results for demand for raw material (p.83,86) and land (p.71).
19.	Flexibility of biofuel policies: impact on investments in technology and yield improvements *"Biofuel policies and their degree of flexibility. It impacts on the overall investment in biofuel technologies and yield improvements (creating positive externalities and reducing LUC for EU policies), the capacity of EU to use foreign production (see 8) but also the global pressure on land and agricultural markets in the baseline"*	High	Results for the impact of biofuel policies (p.37,44,85).
20.	Trade policies can encourage or hinder competition *"Trade policies that shift competitiveness among suppliers or can reduce the access of some producers to the EU market (e.g. antidumping, export restrictions);"*	High	Difference between the "No Trade Liberalization" and "Trade Liberalization" scenario (s.45-47,59).
21.	"Land governance": can pressure on land in developing and emerging countries be regulated by the government *"Land governance in the different countries and the capacity to enforce conservation programs that will limit the agricultural land expansion following*	High	The model ignores legislation to protect land (e.g. sustainability criteria of Directive 2009/28/EC (p.13).

2. "Uncertainties" according to IFPRI			Effects on the results
	a price increase;"		
22.	Public investment in infrastructure *"Public investment in infrastructure (transportation, irrigation) to make new land more easily available (increase LUC, but at the same time improved irrigation on existing land also increases yield leading to reduction in the LUC);"*	High	Impact on model is not transparent. (see item 1)
23.	Public investment in biofuel research *"Public R&D in new technologies to increase yields (at the crop level or at the biofuel conversion/crushing level) will reduce LUC (see item 1);"*		Development of the technology (p.56,60).
24.	Organic farming: lower degree of intensity *"Agricultural policies that promote less intensive schemes with lower yield production (e.g. organic farming). They will increase the LUC effect."*		Intensification (p.55).
25.	All policies that will impact economic conditions (refers to no.11) *"All policies that will have an impact macroeconomic conditions discussed in item (11)"*		Impact on model is not transparent. (see item 1)
	II. Uncertainties with respect to land conversion		
26.	Localisation of land use change by a country and sub-region *"The country and sub-region where the land expansion takes place. This depends of the crop mix required and other factors affecting competitiveness (see items 7, 9,..). Different regions have different biotopes and carbon stocks associated."*	High	Results on scope and type of converted land (p.48, 54) and localisation of converted land (p.50,70).
27.	Scope of conversion of pasture to cropland *"How easily can pasture be converted to crop land? If it is easy, cropland will extend more in pasture and it will mitigate the related emissions compared to deforestation."*	High	Distribution of the new cropland (p.51).
28.	Scope of conversion of forests to cropland *"How elastic is the demand for wood products and how easy is the conversion of managed forest to cropland?"*		Distribution of the new cropland (p.51).
29.	Calculation of CO_2 emissions by hectare and region *"What is the right average value of carbon stocks per hectare in a region? Does the use of averages (as done in this report) induce a bias? Is there a correlation between the initial carbon stock of an area and the potential crop yield? If so, when extension takes place, farmers will naturally targets high carbon stock*	High	Results of CO2 emissions (p.52-53,71) and assumptions (p.93-94).

2. "Uncertainties" according to IFPRI			Effects on the results
	regions first, leading to increased LUC emissions. How to value recently afforested areas?"		
30.	Emissions from peatland *"Peatland emissions. Among all source of emissions, the case of palm trees grown on peatland is among the most sensitive for our results. In recent years, estimates of carbon emissions from peatland have increased systematically and recent research gives a range of 50 to 120 tons of CO2 / Ha / year."*	High	Assumptions for distribution (p.54) and effects on the respective CO2 balance of the biofuels (p.63,71).
31.	Agricultural practices in 2020 *"What will be the agronomic practices in 2020 on the new land? Different depth for tillage leads to different emissions of mineral carbon stored in the soil and can significantly reduce overall emissions. It depends of the availability of technology but also the capacity to adopt them (e.g. Genetically Modified soybean with Round-up and no tilling)"*	High	Impact on model is not transparent. (see item 1)
	III. Political uncertainties		
32.	Legislation and enforcement for land protection *"Any land management policies will have an impact on the type of land that can, or can not, be converted. Legislation, and even more importantly its enforcement, play a critical role in protecting high carbon value areas (conservation programs, forestry code. etc.). Analysis of past behavior through satellite images is a relevant exercise but the margin of errors in such exercise is also very large;"*		The model ignores legislation such as EU cross compliance
33.	Legislation in the agricultural sector *"Regulations affecting the agricultural sector: animal welfare, land set aside etc, may influence the type of land converted (pasture vs forest etc.);"*		Impact on model is not transparent. (see item 1)

3.Data errors			
	IFPRI	**Analysis**	**Error**
34.	Global cropland in the baseline scenario 2008 1.12 billion hectares (MIRAGE-BioF)	Laborde et al. 2011: MIRAGE-BioF simulation: 1.24 billion ha in 2008 Monfreda et al. 2008: 1.29 billion ha in 2000 Global cropland according to FAO in 2008 1.53 billion ha	The value supposedly used of 1.12 billion ha is not the result of the studies cited in this respect by the author and others. Underestimated by 410,000,000 hectares in the baseline scenario
	Source: (S&T)²-Consultants (2011): "Review of IFPRI Reports on Land Use Change from European Biofuel Policies" (p. 19)	*Source: FAOStat (2011): http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor*	
35.	Forecast of fuel demand for 2020 at 316 Mtoe	Forecast for 2020 according to JEC 2011: 281 Mtoe	35,000.000 toe overestimated in the forecast for 2020
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.37)	*Source: JEC Biofuel Programme (2011):http://ies.jrc.ec.europa.eu/uploads/jec/JEC%20Biofuels%20Programme.pdf (p.20)*	
36.	Forecasts for crop yields in 2020	Crop yields significantly underestimated on new cropland	Forecasts of crops underestimated between 25% and 50%
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.40)	*Source: (S&T)²-Consultants (2011): "Review of IFPRI Reports on Land Use Change from European Biofuel Policies" (p. 31)*	
37.	Nature conservation: legislation and regulations	European sustainability requirements are not taken into account	Forest clearances *overestimated* by 660,000 ha
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.13,56)	*Source: IFPRI (2011): "Assessing the Land Use Change Consequences of European Biofuel Policies" (p.13,56)*	
38.	Crop rotation and multicropping	Multicropping is not taken into account in the model	Multicropping underestimated on 150,000,000 ha
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (S.85)	*Source: (S&T)²-Consultants (2011): "Review of IFPRI Reports on Land Use Change from European Biofuel Policies" (p. 44)*	
39.	Forecast of oil price for 2020 ($110)	Model result shows a falling oil price 0.94%	Model result

	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.36), Laborde et al. (2011): Assessing the EU biofuel land use change effects: estimates with the MIRAGE-BioF model and uncertainty" (S.12)	*Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.57)*	contradicts all known forecasts
40.	Baseline scenario 2008: according to IFPRI percentage of soybean in European biodiesel 24%	Soybean in German biodiesel maximum 8%	Soybean percentage overestimated by 67%
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.40)	*Source: Greenpeace (2011): Investigation on diesel, July 2011*	
41.	Oil content of rapeseed: 0.35t vegetable oil per tonne of rapeseed according to IFPRI	Vegetable oil per tonne of rapeseed 44%	Oil content underestimated by 26%
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.100)	*Source: Ufop (2011): „Sortenversuche 2010 mit Winterraps, Futtererbsen, Ackerbohnen und Sonnenblumen" (S.24,25)*	

4.Mistaken assumptions			
	IFPRI	**Analysis**	**Error**
42.	Import demand: EU by bioethanol demand for 2020 will be covered up to 91% by Brazilian bioethanol imports (BAU 48%)	IFPRI thus forecasts growth in cropland of 11% for Brazil although Brazil currently imports bioethanol.	Bioethanol imports from Brazil overestimated by 6,825,000 toe
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.36,38-39)	*Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.36)*	
43.	2020 target: Additional biofuel demand of 15.5 Mtoe for the year 2020	Biofuel demand increases in a "BigBang in a single year by +132%.	The effects of changes such as increased efficiency underestimated
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.37)	*Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.37)*	
44.	High land rents result in new land being converted to cropland (land use change)	Mistaken assumption: the correlation between high land rents and land use change is statistically not significant.	Land use change overestimated.
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.104), Klepper et al.(2011): "Review of IFPRI study" (p.7)	*Klepper et al.(2011): "Review of IFPRI study" (p.7)*	
45.	Modelling the "oilseed sector" not transparent: mistaken	Inaccurate production ratio between oils and co-	Land use change

	focus on the fuel sector, food sector not adequately accounted for.	products as well as the demand for vegetable oils as food	based on biodiesel demand overestimated
	IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.99,106)	*(S&T)²-Consultants (2011): "Review of IFPRI Reports on Land Use Change from European Biofuel Policies" (p. 44)*	
46.	Substitution: high degree of substitution in the model means that demand for vegetable oils always leads to increasing demand for palm oil.	Mistaken assumption: vegetable oils cannot be completely substituted. Standard specifications have to be taken into account for biofuels.	
	IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies" (p.40,59,69)	*(S&T)²-Consultants (2011): "Review of IFPRI Reports on Land Use Change from European Biofuel Policies" (p. 34)*	
47.	Scope of land use change caused by palm oil: 33% on "peatlands" (Indonesia and Malaysia)	New studies show that the assumption of 33% made by Edwards is inaccurate: 13% in Indonesia and 9% in Malaysia	Peatland emissions overestimated (34% of the biodiesel emissions)
	Source: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies"(p.62-63,94), Edwards et al. (2010):" Indirect Land Use Change from Increased Biofuels Demand: Comparison of Models and Results for Marginal Biofuels Production from Different Feedstocks" JointResearchCenter - European Commission.	*EPA (2011):" Spatial Modeling of Future Oil Palm Expansion in Indonesia, 2000 to 2022" (p.26), EPA (2011): "Spatial Modeling of Future Oil Palm Expansion in Malaysia, 2003 to 2022"(p.40), Klepper et al.(2011): "Review of IFPRI study" (p.12-13)*	

Sources: IFPRI (2011):"Assessing the Land Use Change Consequences of European Biofuel Policies", Laborde et al. (2011): "Assessing the EU biofuel land use change effects: estimates with the MIRAGE-BioF model and uncertainty", JEC: Biofuel Programme (2011), (S&T)²-Consultants (2011): "Review of IFPRI Reports on Land Use Change from European Biofuel Policies", FAOStat (2011), EPA (2011):" Spatial Modeling of Future Oil Palm Expansion in Indonesia, 2000 to 2022", EPA (2011): "Spatial Modeling of Future Oil Palm Expansion in Malaysia, 2003 to 2022", Klepper et al.(2011): "Review of IFPRI study", Greenpeace (2011): "Investigation on diesel, July 2011", Ufop (2011): „Sortenversuche 2010 mit Winterraps, Futtererbsen, Ackerbohnen und Sonnenblumen".