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Copa - Cogeca climate change series

INFO SHEET

Crops and climate change

Climate change will present crop producers with both opportunities and risks. It is likely to lead to a decrease in agricultural activities, to a greater risk of crop yields and losses in quality of crops in most European regions leading to an unstable economic situation.

European farmers are already responding to climate change, but the magnitude and complexity of climate change-related phenomena - extreme events such as violent storms, changing rainfall patterns and the arrival of new pests and diseases, will challenge their adaptive capacity.

Adaptation activities on cropland management can also simultaneously deliver mitigation effects, such as more diversified crop rotations and farm activities.

Cropland management and grassland management represent today the highest global biophysical mitigation potential of agriculture[1].

The carbon sequestration potential of agricultural soils in the EU-15 has been estimated at between 60 and 70 Mt CO2 eq[2].

[1] Smith and al. 2008.

[2] Source: EU Project MEACAP (Impact of Environmental Agreements on the CAP).

The specificities of greenhouse gas emissions from crop production

The greenhouse gas (GHG) emissions profile of crop production is fundamentally different to that of other sectors as emissions such as transport. The emissions result from inherently variable, biological processes which are extremely numerous and complex. The management of these intractable emissions arising from biological processes is limited.

Crop production naturally sequesters carbon in soils and biomass during their production processes. Through photosynthesis, plants absorb CO2 from the atmosphere across a wide range of cropping systems in the EU.

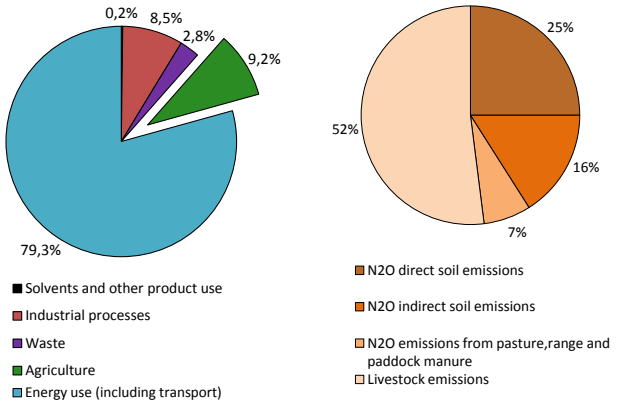
Nitrous oxide (N2O) emissions arise from the application of organic and inorganic fertilisers to soil, as well as from soil microorganism activity through the processes of denitrification and nitrification.

Methane (CH4) emissions arise from anaerobic decomposition of organic material and manure application.

The reduction potential of GHG delivered by crop production practices brings about possibilities in the fight against global warming (nitrous oxide's global warming potential is 310 stronger than CO2[3]).

- Agriculture contributed 9.2% of total GHG emissions in the EU-27 in 2007 (Fig. 1) releasing approximately 462 Mt CO2-eq.

Figure 1: Breakdown of total GHG emissions and agricultural share in the EU-27 in 2007 (N2O emissions)



Source: own work based on data from the EEA (Technical report 4/2009)

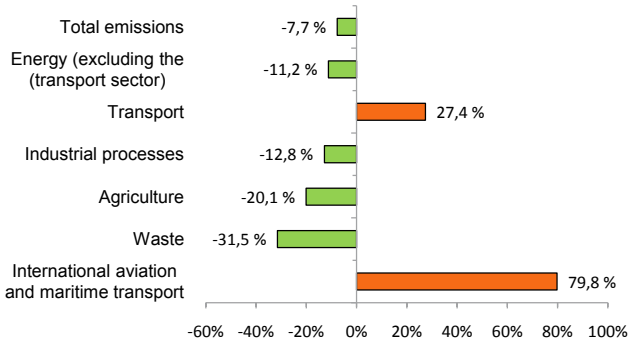
- Agriculture contributes 4.3% and 5% respectively to the EU's total methane and nitrous oxide emissions.

[3] To harmonise GHG's different global warming potential they are accounted in "CO2 equivalents". This means that emissions of 1 million metric tonnes of methane and nitrous oxide respectively is equivalent to emissions of 21 and 310 million metric tonnes of carbon dioxide (EEA and IPPC Third Assessment Report, 2001).

The sector's progress in reducing emissions

- The GHG emissions from agriculture (including livestock) have been reduced by 117 Mt[4] CO2-eq: a reduction of 20% between 1990-2007 in the EU-27 (Fig. 2)[5].

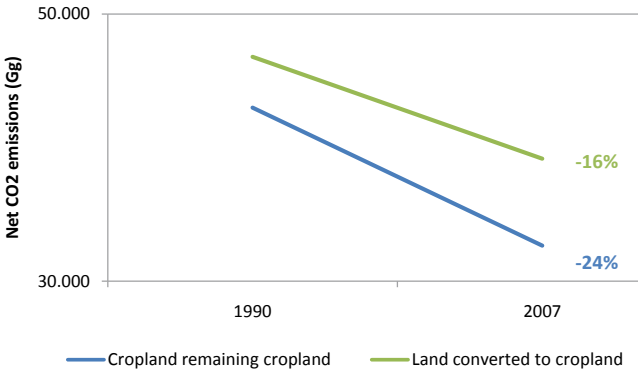
Figure 2 : Changes in EU-27 greenhouse gas emissions by sector, 1990–2007



Source: EEA, Greenhouse gas emission trends - Assessment (March 2009)

- In the EU-27 reported emissions from cropland (categories[6] "cropland which remains cropland" and "land converted into cropland") have decreased in the period 1990-2007 by 24% and 16% respectively (Fig. 3).

Figure 3: Net CO2 emissions of EU-27 from categories "Cropland remaining cropland" and "Land converted to cropland"



Source: Own work based on data from the EEA Technical report 4/2009

[4] One mega tonne (Mt) = 10^6 tonnes.

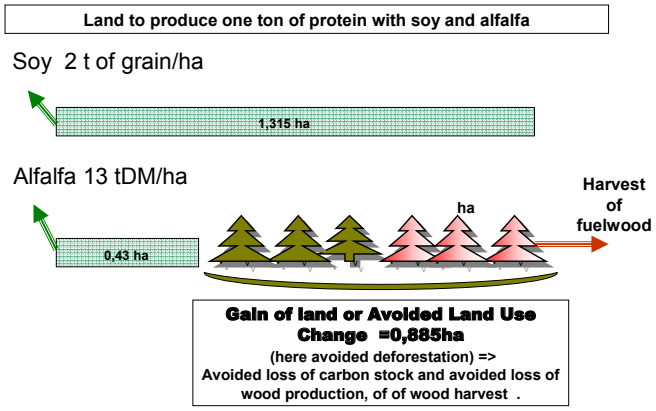
[5] EEA, "Annual EC GHG inventory 1990-2007 and inventory report 2009 (May 2009)".

[6] In the GHG inventory of the European Community for submission to the United Nations Framework Convention on Climate Change (UNFCCC) a "key category" is defined as "an emission source that has a significant influence on a country's GHG inventory (in terms of the absolute level of emissions, the trend of emissions or both)".

- The reduction in emissions from the crops sector is due to better practices: more efficient use of fertilisers and manures, recent structural reforms of the CAP and progressive implementation of agricultural and environmental initiatives.
- Efficiency in the use of nitrogen has increased from 30% in the mid-eighties to its current average level of 60%[7].

A crop such as alfalfa can play an important role in the EU's protein production whilst delivering extraordinary environmental performance. In some EU areas, 0.4 ha of alfalfa is enough to produce one tonne of protein, compared with 1.3 ha of soya. In the area saved it is possible to grow other types of food, to grow energy-crops or reforest the land. In addition, amongst other environmental benefits, alfalfa has a positive impact for all bees and being leguminous, it captures atmospheric nitrogen and therefore does not require high mineral fertilizer application (Fig. 4). 48 % of the agricultural emissions are soil-related in the EU-27 in 2007. The largest share (25%) comes from direct soil emissions.

Figure 4 : Comparison between the land intensity of alfalfa and North America soya for the production of one tonne of protein



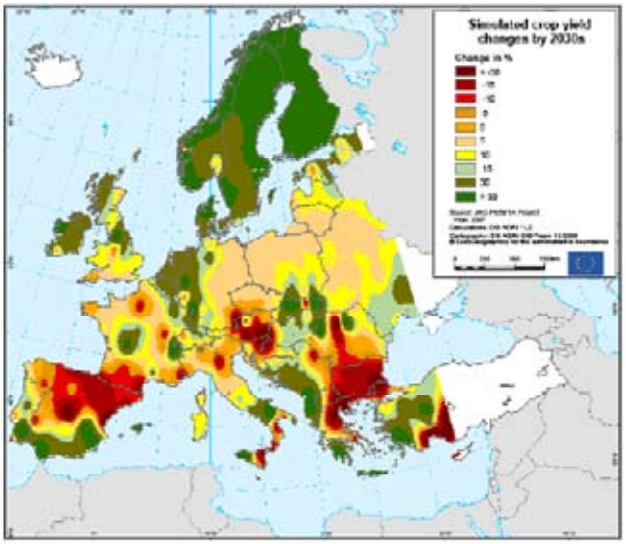
Source: Copa-Cogeca brochure "Lucerne, an asset to the environment" (2007)

Adaptation potential within the EU's crop production

The changing climate could lead to a shift of crop production to the north and higher altitude regions, which would create potential positive impacts of climate change on crops in general related to longer growing seasons and new cropping opportunities from temperature change[8] (warmer winters, reduction of frost frequency in autumn and winter).

By 2030, yields in northern Europe could increase up to+70 % for certain northern EU regions BUT decrease by more than 22 % in southern regions[9] (Fig. 5 - changes compared to 1961-1990).

Figure 5: Simulated crop yield changes by 2030 (reference period 1961-1990)



Source: PESETA project, (Iglesias et al., 2007)

Adapting to the changing availability of water will be critical. Across the EU general negative effects from extreme events, especially from the intensification of the hydrological cycle (summer heat, droughts, heavy precipitation events and floods, storms) are already being felt[10].

Introduction of new varieties and crops more resilient to water scarcity or wetter conditions, as well as robust crop protection measures, will be required and the use of new technologies to improve crops' capacity to adapt.

Practices such as restoring natural features such as hedgerows to help reduce soil erosion as rainfall intensity increases will be needed.

Mitigation potential within the sector

Crop production acts as a carbon sink and consequently plays a key role in limiting global warming and enhancing ecosystem resilience. Farming practices such as reduced tillage, residue management, diversified crop rotations and catch crops foster carbon sequestration and slow down N2O release.

Enhancing nutrient use efficiency by optimizing the timing and application of inorganic and organic fertilisers limit N2O emissions and contribute to a more efficient resource

[7] "Nitrogen Use Efficiency": the relationship between N removed with harvested crops and N application. Source: J. Lamell, Presentation given at the EFMA Conference "Agriculture, fertilizers and Climate Change", Brussels February 2009.

[8] For example, in Germany sowing dates for maize and sugar beet is on average tend days earlier than usual, and in Alsace (Eastern France) grapes' increased alcohol content is due to warmer temperatures and the longer growing season. In other cases grain crop productivity decreases because of premature crop ripening with subsequent negative effects on grain filling.

[9] Source: PESETA (Projection of Economic impacts of climate change in Sectors of the EU based on bottom-up Analysis) is a JRC's multi-sectoral assessment of the impacts of climate change in Europe for the 2011-2040 and 2071-2100 time horizons.

[10] E.g. destructive floods occurred in various areas across the United Kingdom during the summer of 2007, strongly affecting crop production and agricultural economies. Conversely, drought episodes in Cyprus have threaten its crop production so its food supply.

management, also by fostering water efficiency through the management and the implementation of water saving technologies and water storage.

Crop production offers a considerable potential to produce renewable energy and materials providing opportunities to reduce GHG emissions as well as better management of the life cycle of raw materials.

Crops can replace fossil energy sources through a wide variety of bioenergy feedstocks and technologies (biofuels, crop residues, perennial energy crops) which will assist the EU in meetings its Renewable Energy targets.

Moreover, crop materials provide alternatives to industrial materials. Bio-polymers, lubricants, and fibre plant-based products can progressively reduce the need for petrochemical-based products which are energy-intensive.

Challenges ahead

- Establishing a methodology that distinguishes between non influenceable natural conditions and those derived from the anthropogenic activities to overcome uncertainties on the current monitoring and accounting rules for the emissions and removals from land-use, land-use change and forestry activities (LULUCF)[11] is key.
- Appropriate incentives facilitating research and investment into technologies focused on gas emissions reduction and on productivity improvements can foster the mitigation potential of crop production.
- A reduction in the EU's crop production due to the selection of one-side mitigation options would lead to a shift in production which would affect the EU food supply, damage EU agri-food and displace emissions towards third countries (e.g. glasshouses covered under the "ETS").
- Education, training, advice and demonstration activities are key tools for awareness-raising amongst the farming community by targeting the local needs and problems.
- Plant protection products are used today in a highly targeted way, through efficient rather than heavy-handed applications. Because of changing climate conditions, new science-based products and practical applications will be required to fight emerging pests and disease threats.

[11] Kyoto Protocol.

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