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SOYBEAN BIOMASS PRODUCED IN ARGENTINA: MYTHS AND REALITIES

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INTRODUCTION

Soybean biomass for biodiesel has been proposed as a means of reducing greenhouse gas emissions, as compared to fossil fuels. Several EU institutions and governments are designing certification schemes for the sustainable production of biomass. This study questions the validity of the proposed environmental standards, using as a case study the production of Argentine soybean.

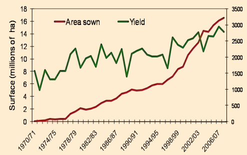
Soybean production has profound environmental impacts. The use of pesticides induces resistance in weeds, leading to an increase in the quantity and variety of pesticides used. Soil fertility in decline is addressed by using synthetic fertilisers, whose production is energy intensive and whose use generates emissions of N_2O. The quantity of substances sprayed by terrestrial and aerial means has negative impacts on biodiversity, water, soil, and human and animal health. This intensive production also has social impacts, including loss of livelihoods and food sovereignty and rural exodus. The demand for soybean is a driver of deforestation and the loss of native habitats, vital to climate stabilisation. Several studies have causally related deforestation to the outbreak of diseases in human populations.

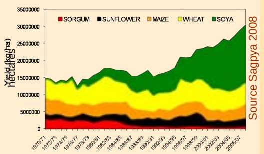
The atmospheric impact of soybean cultivation has not been tested *in situ*. Some of the models for climate impact (N_2O emissions, etc) are based on *in vitro* studies, while field data are scarce. The situation has not been sufficiently researched in the EU or anywhere else. Furthermore, there are serious issues of enforcement of the environmental legislation in production countries, particularly now that EU countries are adopting mandatory blending of biofuels with fossil fuels. This study considers that a certification system will not create the conditions for environmental sustainability. It concludes that certifying soy monocultures as 'sustainable' would exacerbate existing climatic and environmental problems.

Demand due to EU biofuels obligations is one of the main drivers for increased soy crushing plant capacity in Argentina. Soy imports from Paraguay, Brazil and Bolivia will also be required, most of which are likely to be GM. In 2007 over 20 biodiesel projects were announced. If they were all come on line, production would exceed 2 billion litres by 2010 (GAIN Report: 2007).

IMPACTS OF SOY-BEAN PRODUCTION

Deforestation: The clearance of native forests and scrub is done by machines, fire, and aerial application of herbicides. Increased global demand for biofuels will lead to a further extension of the agricultural frontier in Argentina. In the Chaco region, there are plans for circa 3 million hectares of new lands to be used for the production of biofuel feedstocks, incl. soybean (Pengue 2007).



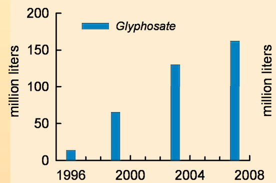


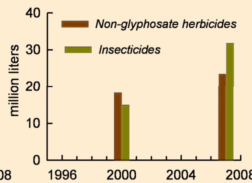
Estimates of the atmospheric impacts of soybean cultivation, for which field data are scarce, are mostly based on *in vitro* studies. In Argentina, soybean cultivation is the main source of non-CO_2 greenhouse gases (N_2O, CH_4) from agriculture (Taboada 2004). Emissions from soybean cultivated soils have been established (Dalgaard *et al*. 2008; Panicelli *et al*. 2008; Sheehan *et al*. 1998). However, it is difficult to measure N_2O emissions as these are highly variable, both during and between seasons.

Evidence for increased carbon sequestration in no till agriculture is not compelling. In Argentina, all GM soybean is cultivated using no till (NT) methods. According to the IPCC methodology, conversion from conventional tillage (CT) to NT leads to an increase of 10% in carbon sequestration in the soil. However, recent studies have cast doubt on these claims (Baker *et al*. 2007). There is a poor understanding of how tillage controls soil respiration in relation to N_2O emissions and denitrification. In another study, higher CO_2 & N_2O fluxes were measured in NT as compared to soil, irrespective of the nitrogen source and moisture content (Xuejun et al. 2007).

It is assumed that these agricultural residues are buried. However conclusive information on the possible emissions from 18 million hectares under no-tillage is still missing (Taboada 2004).

Increasing use of pesticides: The production of soy is dependent on agrochemicals, which have negative environmental impacts, including increased resistance to pesticides. This in turn leads to an increase in the quantity and the types of pesticide used.

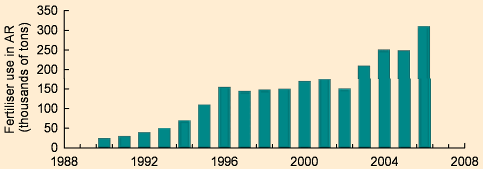




Soil compaction, caused by the lack of soil turning, and the heavy equipment used for seeding and harvest, and is associated with NT agriculture (Gerster *et al*. 2008). It is considered by some sourcesto be one of the main factors driving the increased use of fertilizers and herbicides on soybean under NT (Benbrook 2003).

Soil demineralisation:Continued increases in yields of soybean crops are followed by steep declines in soil elements N, P, K and S. N-deficiencies are especially high, despite the ability of soybeans to fix nithogen biologically (Austin et al. 2006, CASAFE 2007).

Eutrophication: Current agricultural practices, which rely heavily on continuous additions of glyphosate, may alter the structure and function of many natural aquatic environments (Perez *et al*. 2007).



Problems of enforcement of environmental laws: Deforestation and the use of pesticides are two environmental concerns related to Argentinean GM soybean cultivation. Legislation regarding the use of agrochemicals close to communities has also proved difficult to enforce. An increasing body of evidence demonstrates that aerial fumigations continue, with deleterious effects on the health of communities, yet in the majority of cases these go un-investigated and therefore unpunished (GRR 2009; Página12 2009). Since national legislation forbidden the clearance of native forest 137 000 ha more of forest have been cleared.

Yield increases to address negative environmental impacts: Panicelli et al. (2008) proposed a 10% increase in the soybean yield, with the same inputs. Steinbrecher and Lorch (2008), have, however, pointed out that none of the existing GM crops in commercial cultivation are engineered specifically for increased yields. If practices remain the same, including the use of GM herbicide tolerant crops, the only possible route to improved yields is first to breed high yielding varieties and then genetically engineer them for herbicide tolerance (HT), or to cross them into current HT lines.

CONCLUSIONS

Certification schemes, however well-meant, are not going to be able to address the environmental and social problems of GM-soybean cultivation. While the political, environmental and social conditions vary according to feedstock and producer country, it is clear that too little is known about the impacts of agricultural feedstock production and that further, context specific research is urgently required. For Argentina, the development of life cycle analyses (LCA) specific to the production of feedstocks in different regions are a high priority. LCAs should be carried out using data obtained *in situ* and not by computer modelling using standard data (i.e. default values). The inclusion of inputs such as fertilisers and herbicides, and the direct or indirect impacts of changes in land use will be necessary if such studies are to adequately reflect the systems being modelled.

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