Greenhouse Gas Assessment of Soybean Biodiesel in Brazil

Xin You[1,2], Guilheime S. Raucci[2], Carlos C. Cerri[2], Carlos E. Cerri[2], Priscila A. Alves[3], Francisco F. C. Mello[3], Leidivan d. A. Frazao[2], and Cindy S. Moreira[3]

[1] University of Hohenheim, Stuttgart, Germany; [2] University of São Paulo, College of Agriculture „Luiz de Queiroz“, Piracicaba, Brazil; [3] Delta CO2 – Sustentabilidade Ambiental, Piracicaba, Brazil

Introduction

Soybean biodiesel (B100) has been playing an increasingly important role in promoting Brazilian bio-based economy and its life cycle (LC) Greenhouse gas (GHG) emissions has received particular attention among decision makers in business and politics, as well as consumers. The aim of this study was to assess the GHG emission of Brazilian soybean biodiesel with an integrated LC approach of 4 stages: agriculture, extraction, production and distribution.

Material & Methods

The data was collected from Mato Grosso (MT), Center West Brazil. We applied a 3-year average (07/08 - 09/10) for agriculture stage and took year 2008/2009 into account for other three stages. The calculation was based on the guideline from IPCC, ISO and former literature reported cases. Final B100 was delivered to Paulinia Refinery (PA), which is further distributed for domestic use.

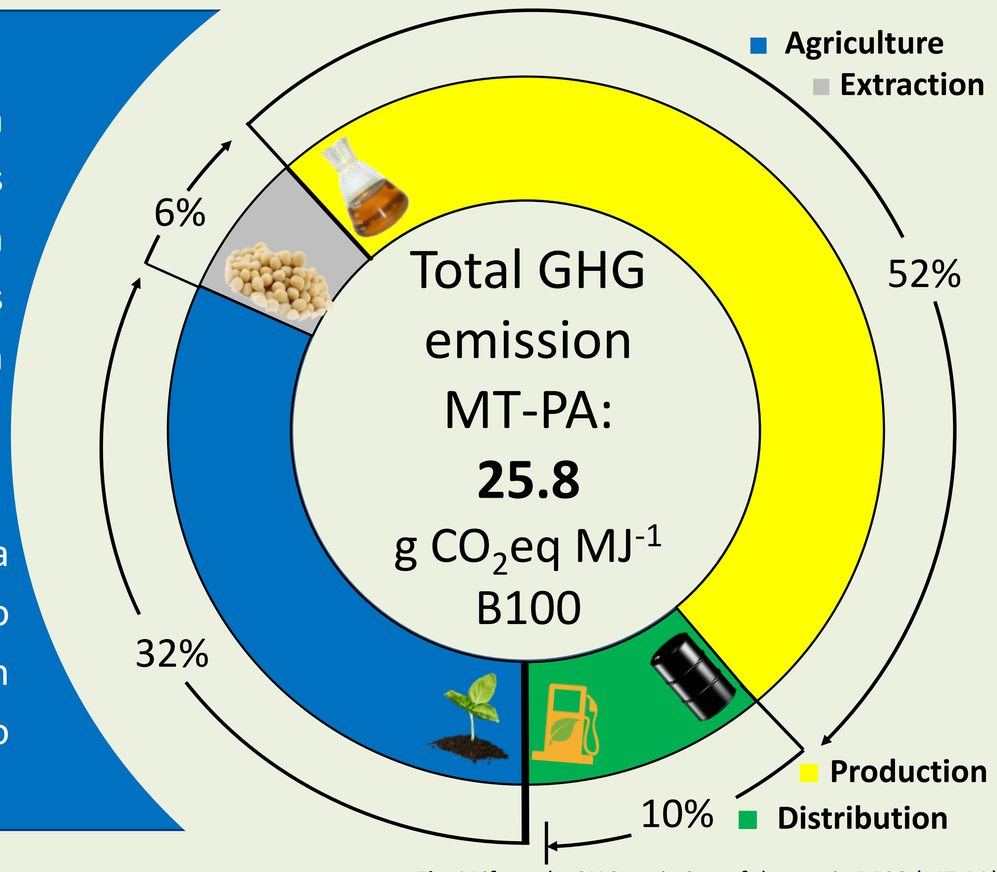

Fig.1 Life cycle GHG emission of domestic B100 (MT-PA)

Decomposition of crop residues: **36**% | Fuel use: **19**% | Fertilizer application: **16**% | Liming: **13**% | Seeds: **8**% | Pesticides: **8**%

Fig. 2 Contribution of different field GHG emission source with illustration and percentage

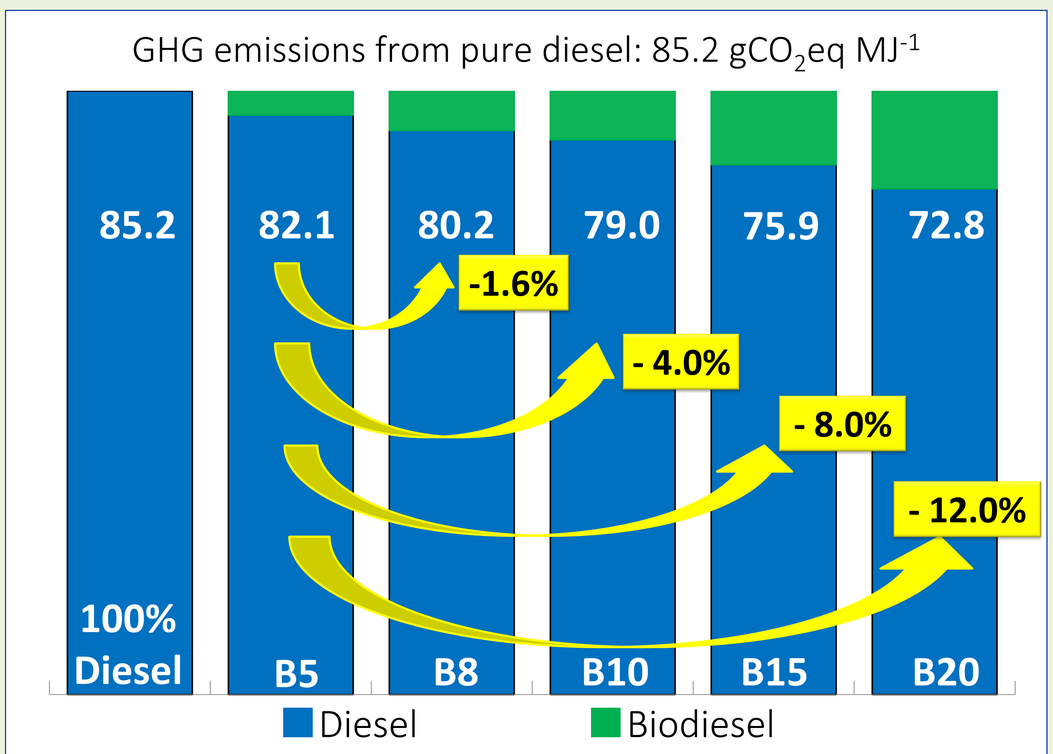

Fig. 3 Projection of GHG emission reduction of Diesel blended with soybean biodiesel

Results and Conclusions

- LC GHG emission of domestic B100 from non-integrated system is 25.8 g CO_2eq MJ^{-1}. Irrespective of land use change (LUC), our result is consistent with other biodiesels and even shows slight advantage over rapeseed oil (*Uusitalo et al.,* 2014)
- Production stage (52%) are the largest GHG emission source among all life cycle stages (*fig.1*), showing emerging integrated system combining extraction and production stages might have high potential in LC GHG emission reduction
- In agricultural stage (32% of the LC GHG emission), the largest GHG emission source comes from decomposition of field residues, followed by fuel use and fertilizer (*fig.2*), suggesting the great potential of good residue management practices on mitigation of field GHG emissions.

Policy Implications

- In compliance with the Brazilian National Program (PNPB) to applying B8 (March 2017), B9 (March 2018), B10 (March 2018) (*Brazil*, 2016) or even possible B15 and B20, the study suggests a great potential of blending B100 in enhancing the environmental sustainability of the Brazilian national energy system (*Fig. 3*)
- B100 (MT-PA) shows favorable condition (68% reduction of LC GHG compared to EU fossil diesel) in international market
- Emerging integrated system might further increase the environmental sustainability of B100. However, re-assessment considering the C debut from LUC is essential for evaluating the fair use of land resource.

Contact:

Xin YOU (Xin_You@uni-hohenheim.de)
Group of Biobased Products and Energy Crops (340b), Institute of Crop Science, University of Hohenheim, 70599, Stuttgart, Germany

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DELTA CO2 Sustentabilidade Ambiental
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