Environmental footprint of ProTerra-certified soybean products

June 2023

ProTerra™ FOUNDATION

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1. Introduction

The growing demand for animal feed leads to an increase in the growth of crops such as soy since soy meal is a relevant protein in animal diets. Agricultural production implicates land use and potential direct land use change (LUC), such as land occupation and transformation. LUC is one of the major issues facing the global agricultural production system. When forests are for instance cleared to make way for agricultural purposes, the carbon stored in the trees and soil is released into the atmosphere in the form of carbon dioxide (CO^2) and other emissions. Therefore, LUC is a significant driver of global climate change.

In Brazil, one of the world's leading producers of soybeans, the expansion of soy cultivation over native vegetation has been a hot topic in discussions regarding the sustainability of Brazilian agriculture production. Expansion can occur through the displacement of other crops on existing farmland or through the displacement of other types of land, such as pasture, meadow, or natural vegetation.

The ProTerra Foundation is a not-for-profit organisation that promotes sustainable food and feed supply chains. In 2006, the ProTerra Standard was created to trace and communicate non-GMO crop production and promote sustainable crop production, storage and processing. One of the main activities of the ProTerra Foundation is to make sure that sustainable Brazilian soybean products are available on the European market. ProTerra-certified material is deforestation-free with a cut-off date of 2008, protects natural habitats and ecosystem services by adopting the High Conservation Values concept as defined by *HCV Resource Network* and promotes environmentally and socially responsible soy production.

ProTerra asked Blonk to analyse the environmental footprint of the ProTerra Standard certified soybeans, soybean meal and oil. A Life Cycle Assessment (LCA) is performed including the following environmental impact categories: carbon footprint, water consumption and land use. ProTerra-certified products are also compared with the respective, default *Agri-footprint* values.

2. Methodology and background

2.1 Scope of the study

The present study aims to make the differentiation between certified and non-certified products clear, and offer ProTerra customers improved quality data for their carbon footprint calculations.

The study covers the following products:

- **Soybean production**
- **Soybean meal**
- **Soybean oil**
- **Soy protein concentrate (SPC)**

The following environmental impact categories are in scope:

- **Carbon footprint (tonne CO^2eq/ton)**
- **Water consumption (m^3/ton)**
- **Land use (m^2/ton)**

The system boundaries are set from cradle to European port.

The included life cycle stages are **soybean cultivation, transport from farm to crusher, soybean crushing**, and **transport to the European market.**

Functional units are as followed for the different selected products:

- **1 ton of Soybean**
- **1 ton of Soybean meal**
- **1 ton of Soybean oil**
- **1 kilogram of Soy Protein Concentrate**

2.2 Compliance

The calculations in this study are as much as possible aligned with EU PEF guidelines (European Commission Product Environmental Footprint), in terms for example of allocation method use and land use change accounting approach (see also paragraph 2.3.1) [1]. Land use change values are based on the BRLUC methodology and state-specific information. This approach has been used as scientifically sound and also for more accurately reflecting the Brazilian reality where ProTerra certification takes place. The use of state-specific information leads to relatively higher (appr. 20%) land use change impact per ton soybean compared to using the national statistical information.

2.3 Data use

For LUC, primary data collection was performed among ProTerra-certified farmers who were selected through a sampling procedure. The environmental footprint calculations are based on state-specific secondary agricultural data from Embrapa, the Brazilian Agricultural Research Corporation. This agricultural data includes, for example, yields, fertilization information, irrigation data etc. Data from 4 Brazilian states were included: Goiás (GO), Minas Gerais (MG), Mato Grosso (MT) and Paraná (PR). Based on the origin of the ProTerra-certified soybean, a weighted average was used [2].

In the agricultural stage, no impact is allocated to other crops in a crop rotation system, even though it is common practice in some Brazilian regions to grow corn as a second crop in the same soybean cultivation area. This rotation brings benefits for both soybean and corn cultivation, however, the environmental impact of the agrochemical inputs was attributed entirely to soybeans and no direct benefits from the previous crop are considered. This approach is also applied in Agri-footprint methodology. Furthermore, LUC emissions from the production area were also totally attributed to soybean production, in line with the guidelines of the BRLUC model.

[1] This study was not externally reviewed based on ISO 14040/14044.

[2] Goiás 5%, Minas Gerais 13%, Mato Grosso 66%, Paraná 16%

For the production of soybean meal and oil (soybean crushing), primary data was available through the soybean crushers, while data from the Agri-footprint 6 database was used for transport to Europe.

In the case of the European production, a ProTerra-specific European production mix was used based on the volumes certified in 2022: Ukraine (48%), Italy (33%), Austria (9%), France (5%), Romania (3%) and Poland (1%). Default processes from Agri-footprint 6 were used to model the cultivation stage.

2.3.1 Direct Land Use Change

In environmental assessments, such as LCA, the LUC emissions must be accounted for. According to several LCA guidelines and standards, such as the EU Product Environmental Footprint (PEF), the contribution of LUC should be monitored for a period of 20-years retrospectively to the current year. In general, land conversion data is collectively available at a country or state level, through international or national statistics and not available at a farm level.

In this study, BRLUC model (Novaes et al., 2017) was used to account for direct LUC emissions. The reason for choosing this method is that it brings regionalized data considering the differentiation of land use transition patterns for all Brazilian states and agricultural products, including soybeans. Its temporal coverage ranges from 1999-2018, being aligned then with IPCC default 20-years horizon.

Within this study primary data was used from a survey done among ProTerra-certified farmers and satellite imagery, which aimed at knowing if LUC occurred before 2008. Data from this survey and their use is presented in paragraph 2.3.2.

2.3.2 Different cases considered for LUC

Primary data collection was performed among the Brazilian ProTerra-certified farmers in 2022. In total 210 out of 452 farmers have been checked through a questionnaire or satellite imagery, of which 184 had no LUC before 2008.

For the LUC accounting in this report, two cases were defined, as those presented in Table 1 for Case I and Case II. In the "Results" chapter the results for case I and case II are presented.

TABLE 1 OVERVIEW OF THE TWO CASES

		Case I	Case II
ProTerra Farmers	**#**	**Previous and current approach**	**Proposed improvement**
Replied-no LUC	184	Zero LUC	Zero LUC
Replied-LUC[3]	26	Default LUC	100% deforestation
No reply	242	Default LUC	Default LUC
Total farmers	452	-	-

3. Results

3.1 Soybean at farm

A tonne of ProTerra soybean at Brazilian farm:

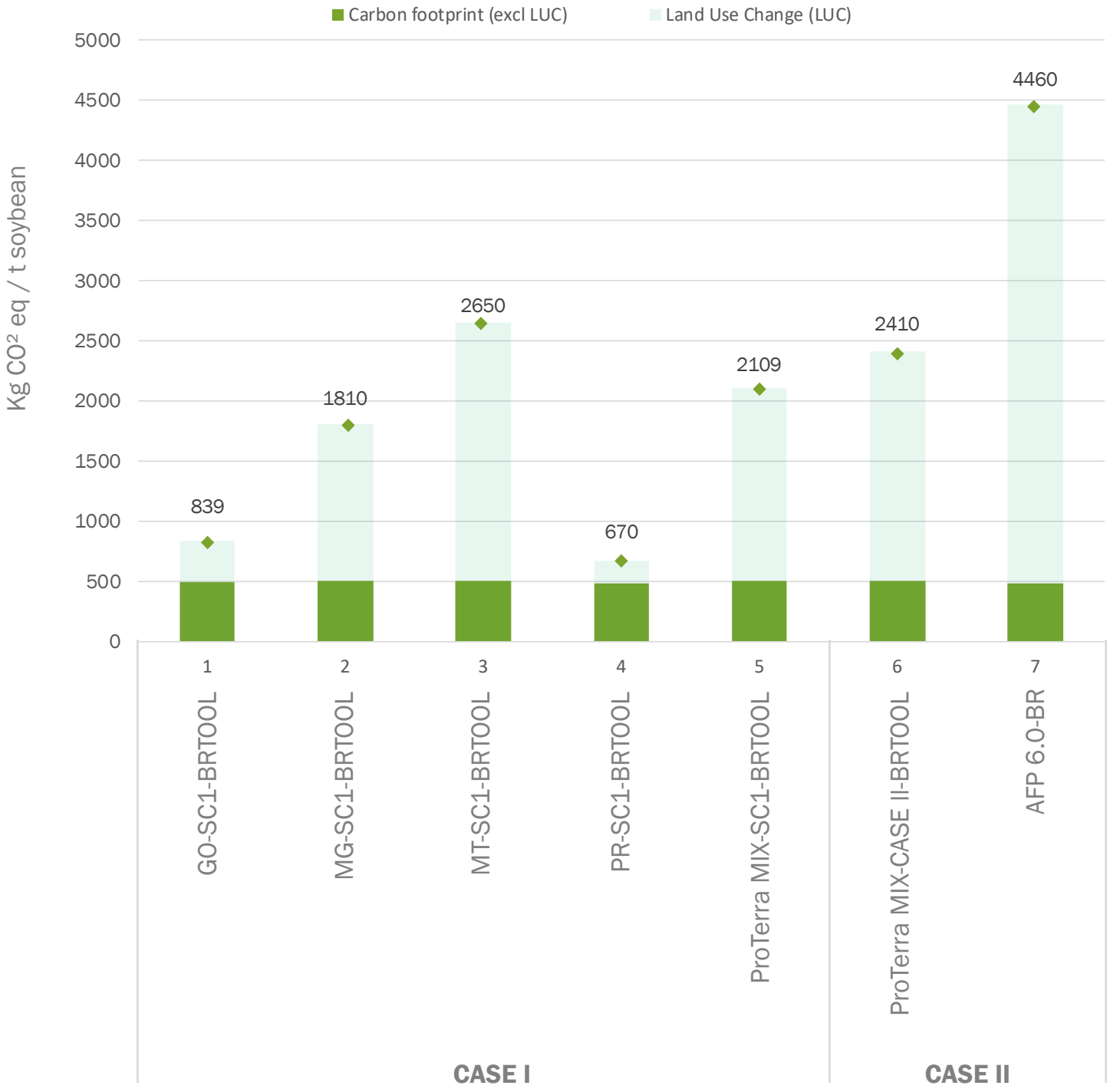
Case I - Carbon footprint	2,11 ton CO^2-eq/ton Soybean
Case II – Carbon footprint	2,41 ton CO^2-eq/ton Soybean
Water consumption	0,22 m^3/ton Soybean
Land use	3075 m^2/ton Soybean

Results in Agri-footprint 6:

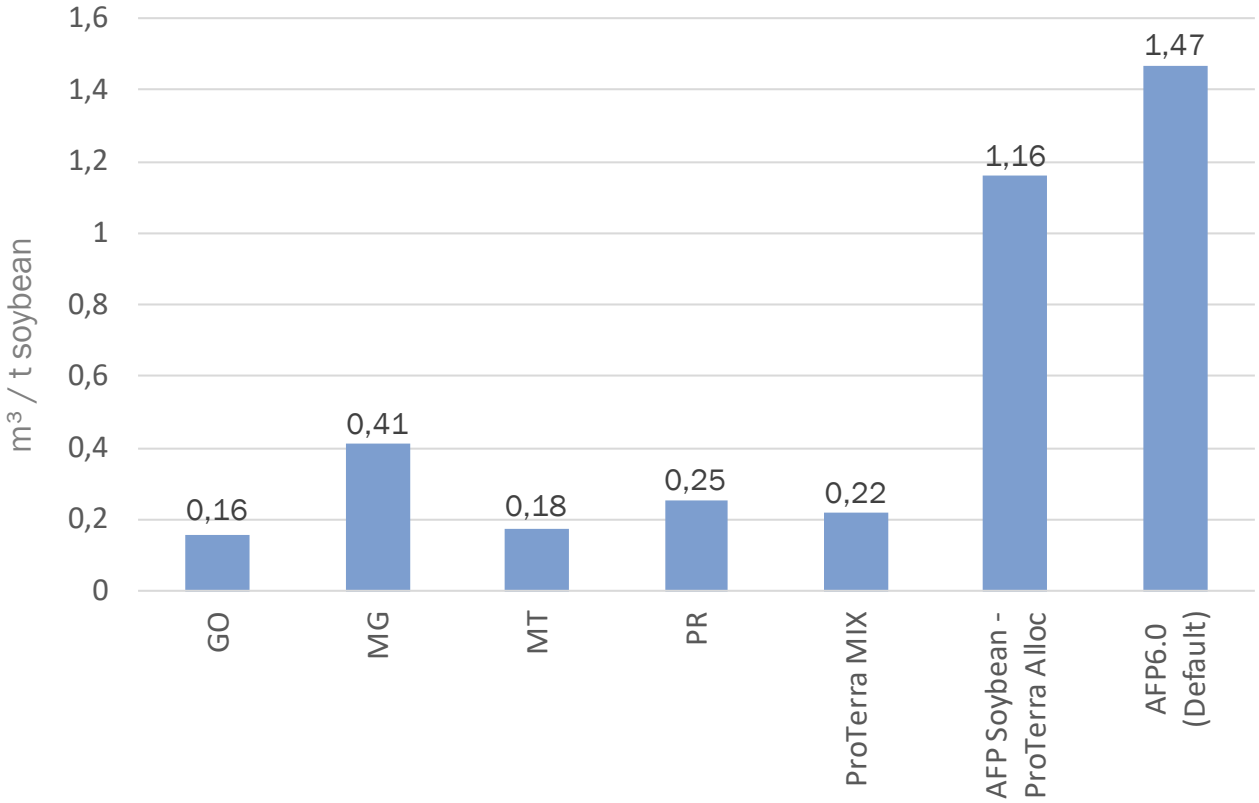
Carbon footprint	4,46 ton CO^2-eq/ton Soybean
Water consumption	1,47 m^3/ton Soybean
Land use	3338 m^2/ton Soybean

[3] LUC between 2002 and 2008

CARBON FOOTPRINT



WATER CONSUMPTION



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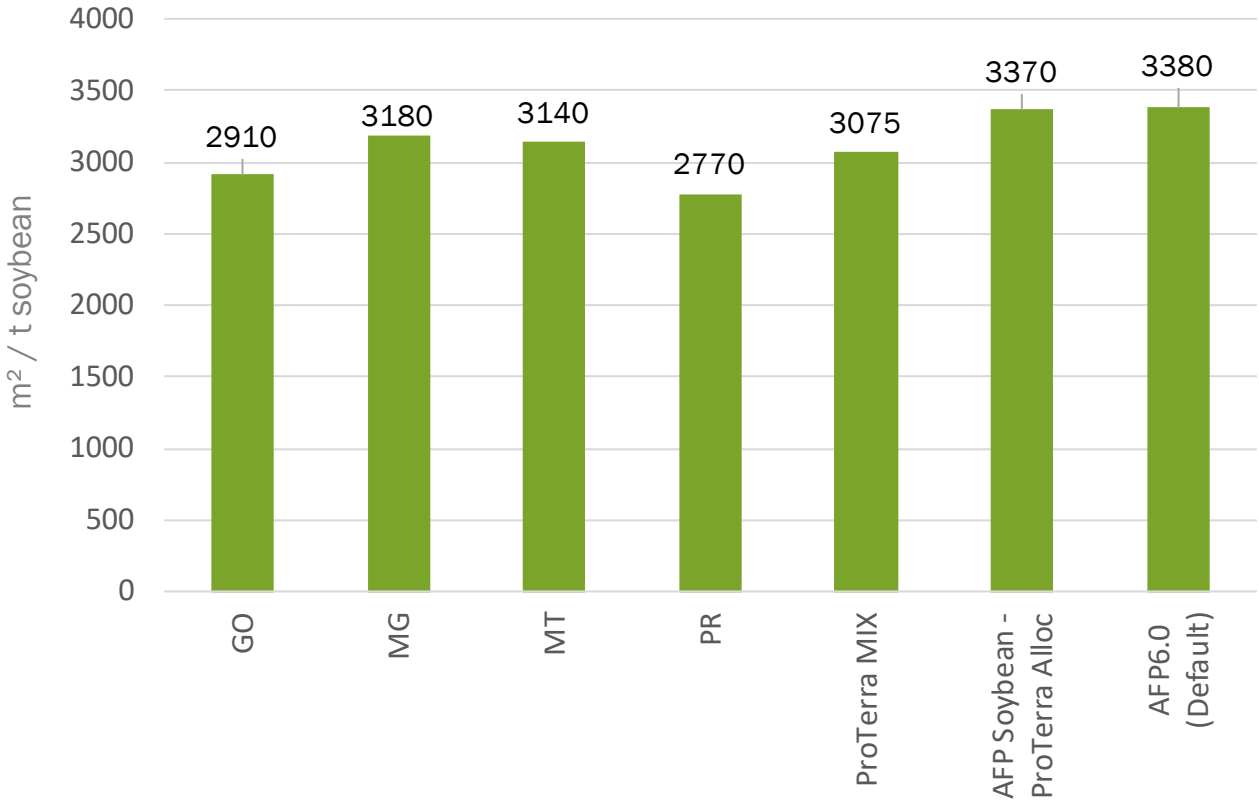


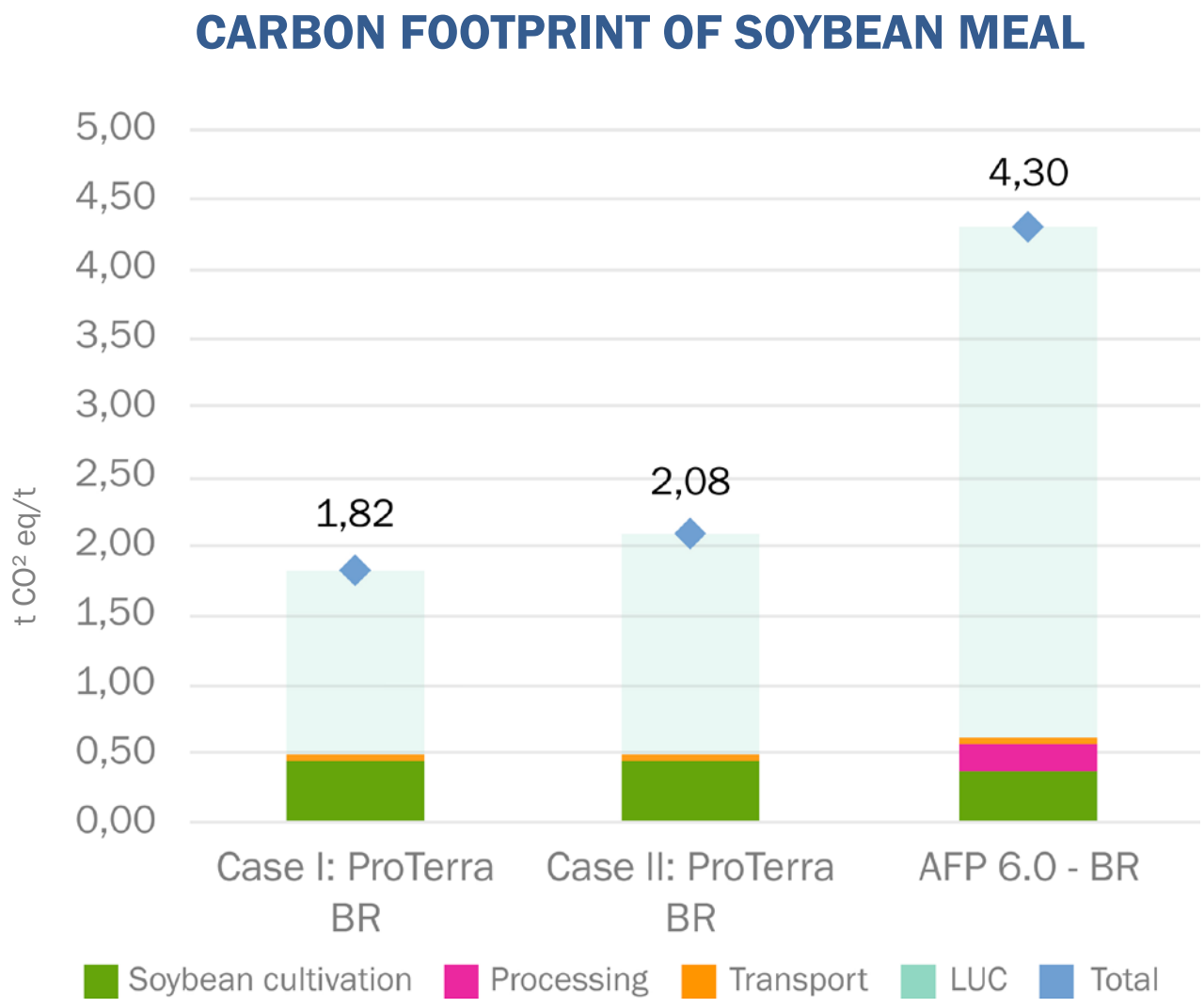
3.2 Soybean meal

A tonne of ProTerra soybean meal from Brazil and used in Europe:

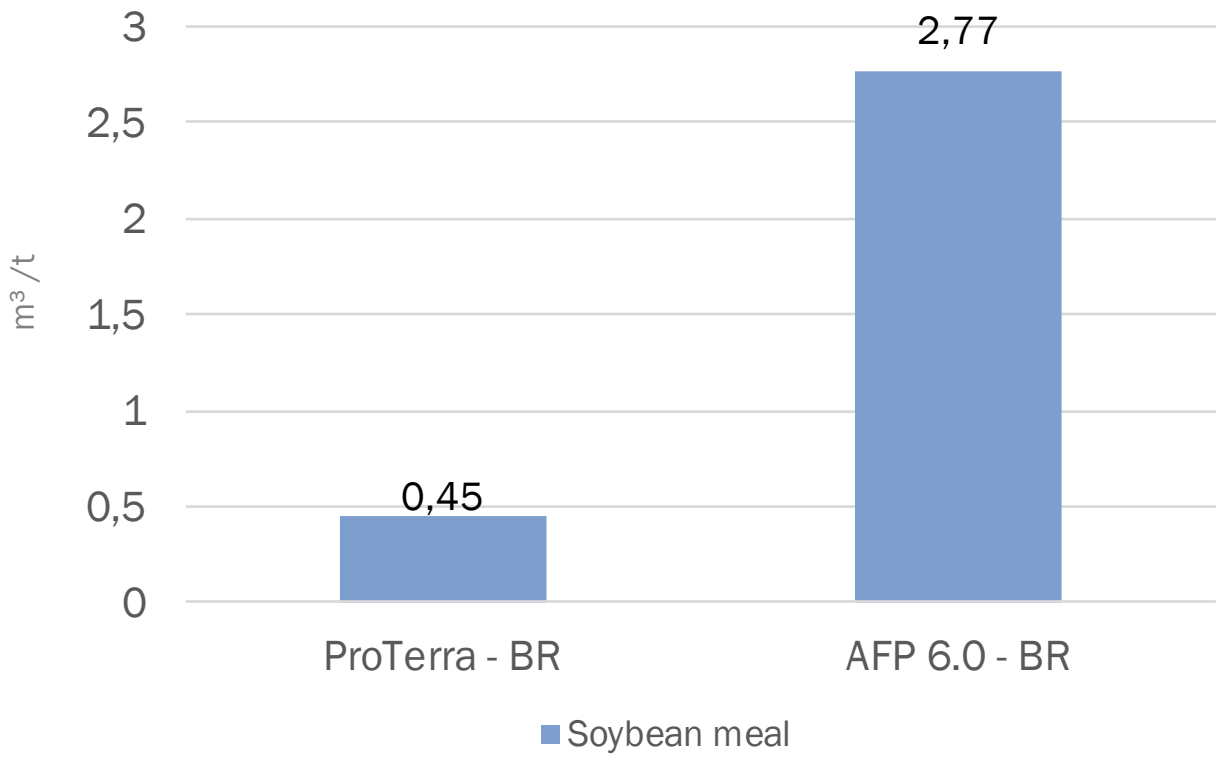
Case I - Carbon footprint	1,82 ton CO^2-eq/ton Soybean meal
Case II – Carbon footprint	2,08 ton CO^2-eq/ton Soybean meal
Water consumption	0,45 m^3/ton Soybean meal
Land use	2650 m^2/ton Soybean meal

Results in Agri-footprint 6:

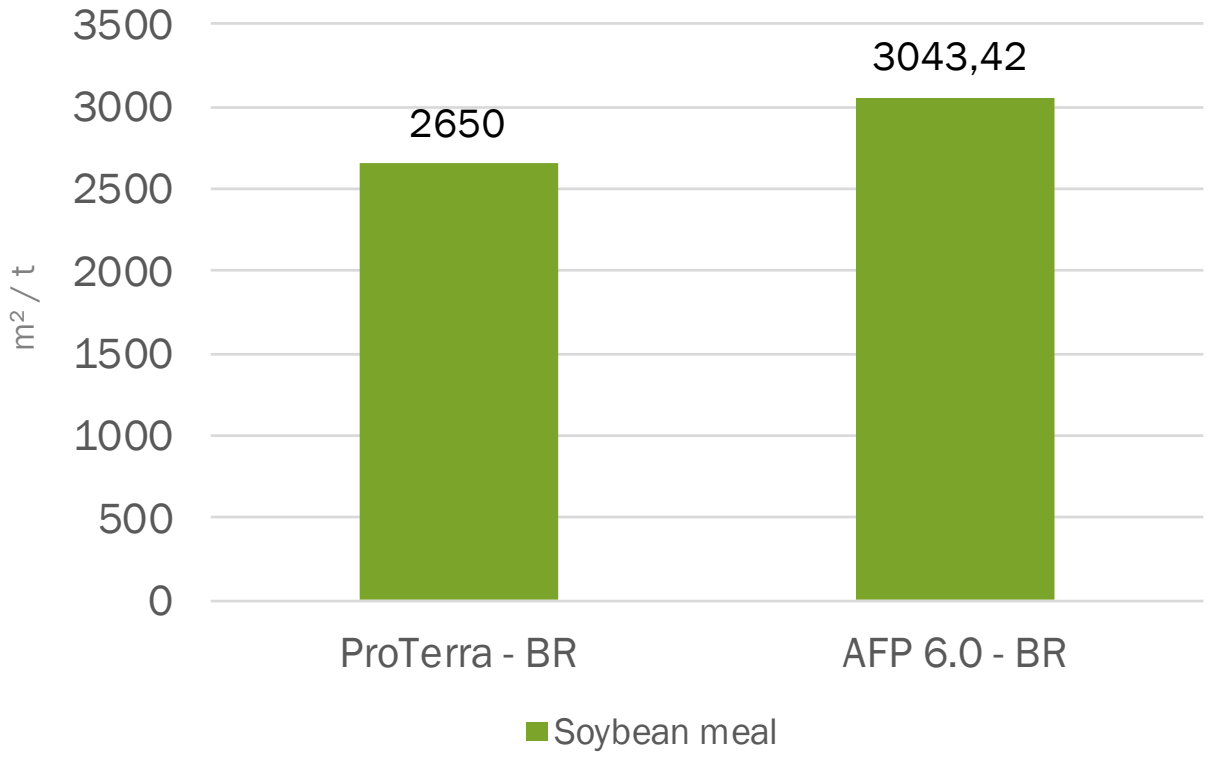
Carbon footprint	4,30 ton CO^2-eq/ton Soybean meal
Water consumption	2,77 m^3/ton Soybean meal
Land use	3043,42 m^2/ton Soybean meal



WATER CONSUMPTION OF SOYBEAN MEAL



LAND USE OF SOYBEAN MEAL



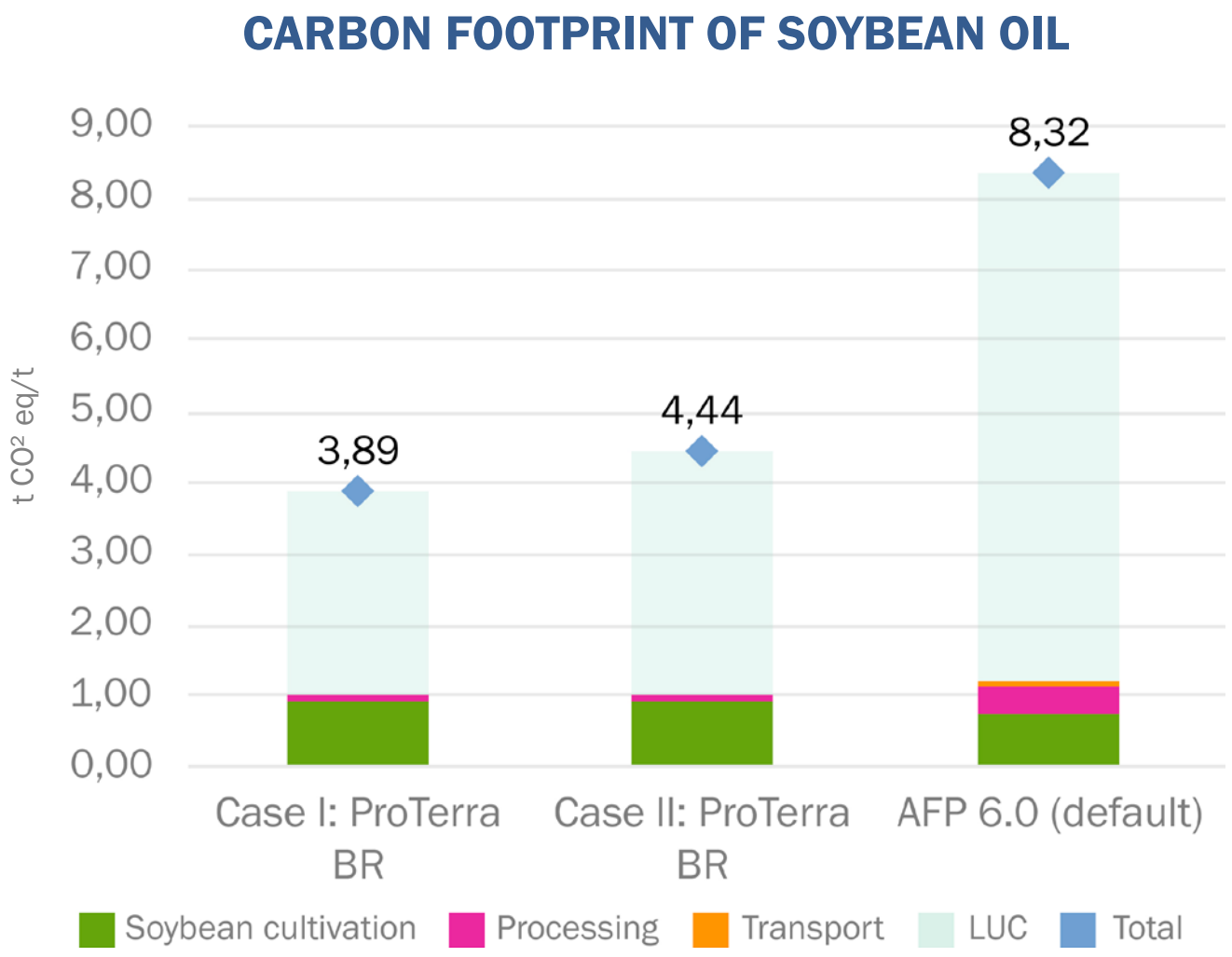
3.3 Soybean oil

A tonne of ProTerra soybean oil from Brazil and used in Europe:

Case I - Carbon footprint	3,89 ton CO^2-eq/ton Soybean oil
Case II – Carbon footprint	4,44 ton CO^2-eq/ton Soybean oil
Water consumption	0,971 m^3/ton Soybean oil
Land use	5730 m^2/ton Soybean oil

Results in Agri-footprint 6:

Carbon footprint	8,32 ton CO^2-eq/ton Soybean oil
Water consumption	5,37 m^3/ton Soybean oil
Land use	5907 m^2/ton Soybean oil



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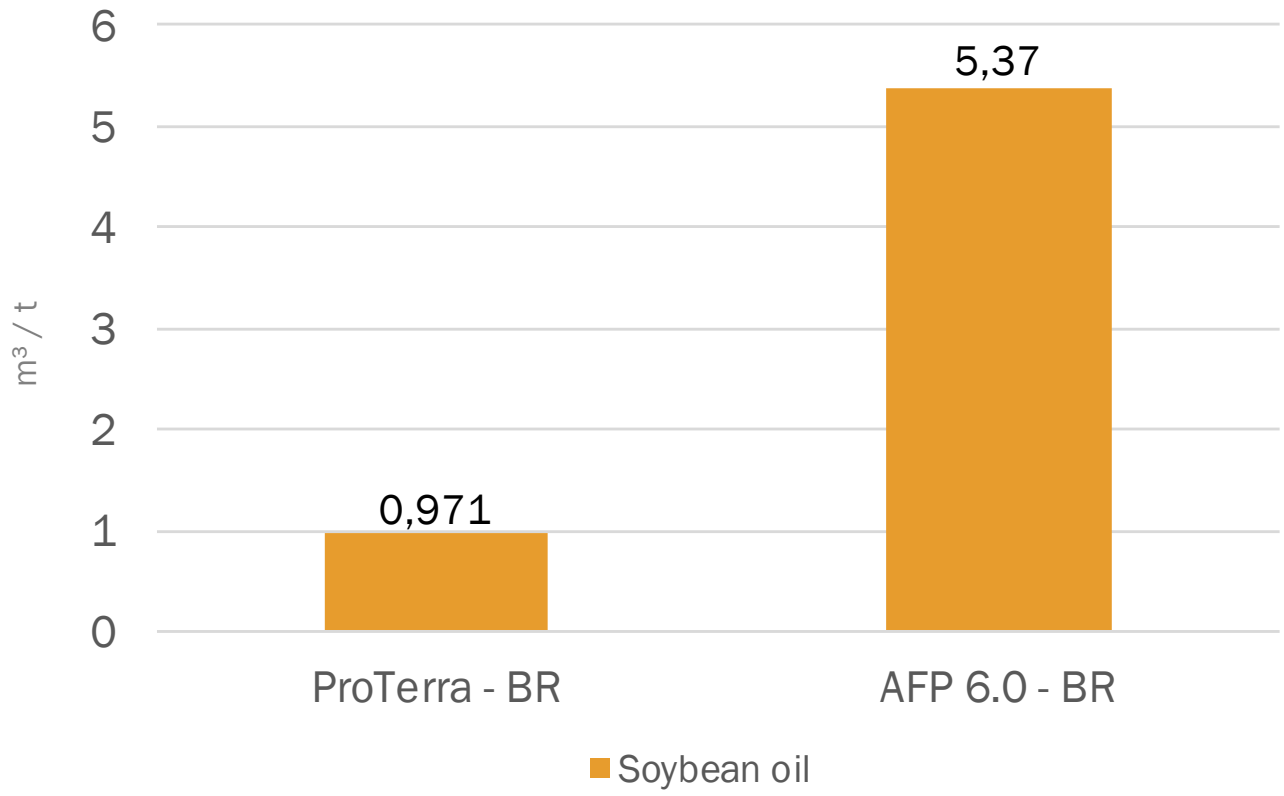
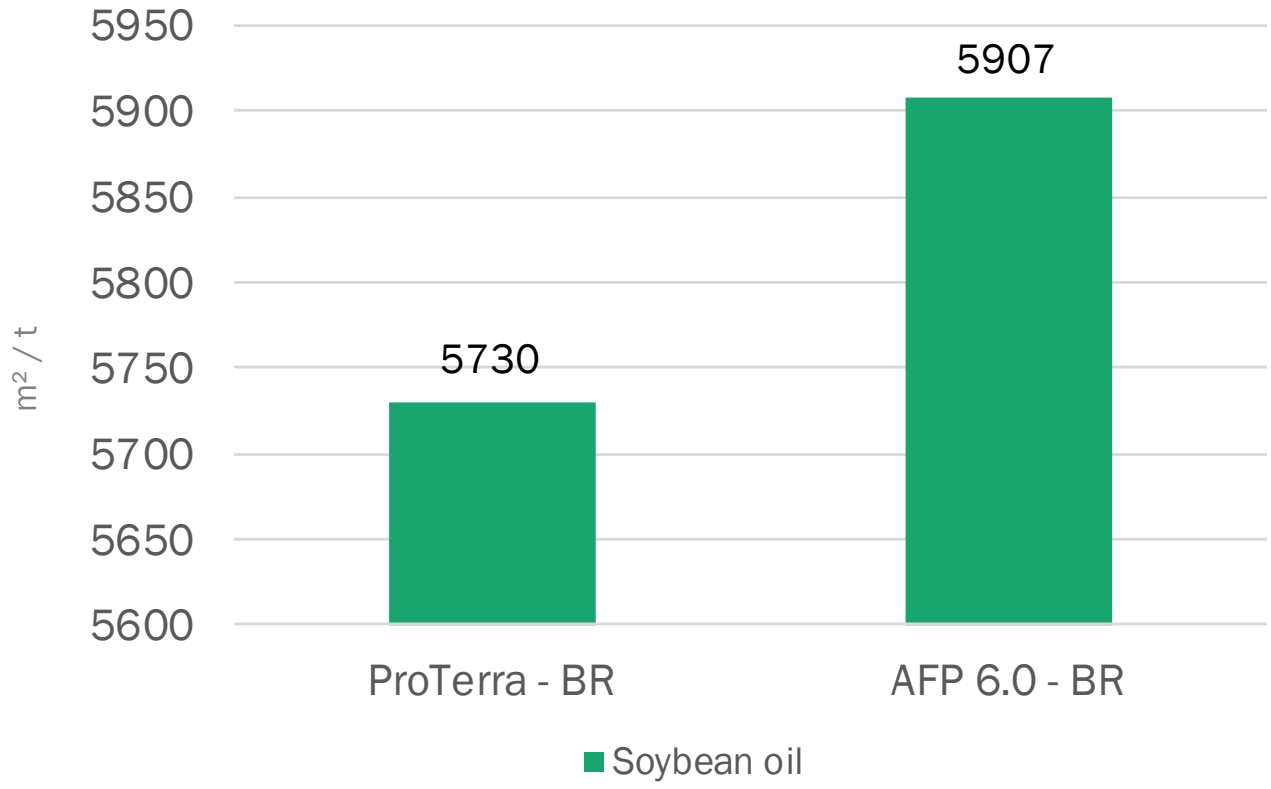


LAND USE OF SOYBEAN OIL



3.4 Comparison with European soybean meal and oil

The calculated environmental impacts of Brazilian ProTerra products have been compared to the ProTerra-specific European production mix. While the carbon footprint of Brazilian soybean products is much higher than the European ones, the land use and water consumption are lower due to higher yields and less irrigation. Moreover, when LUC emissions are excluded, the Brazilian soybean products have a lower carbon footprint.

3.4.1 Soybean meal

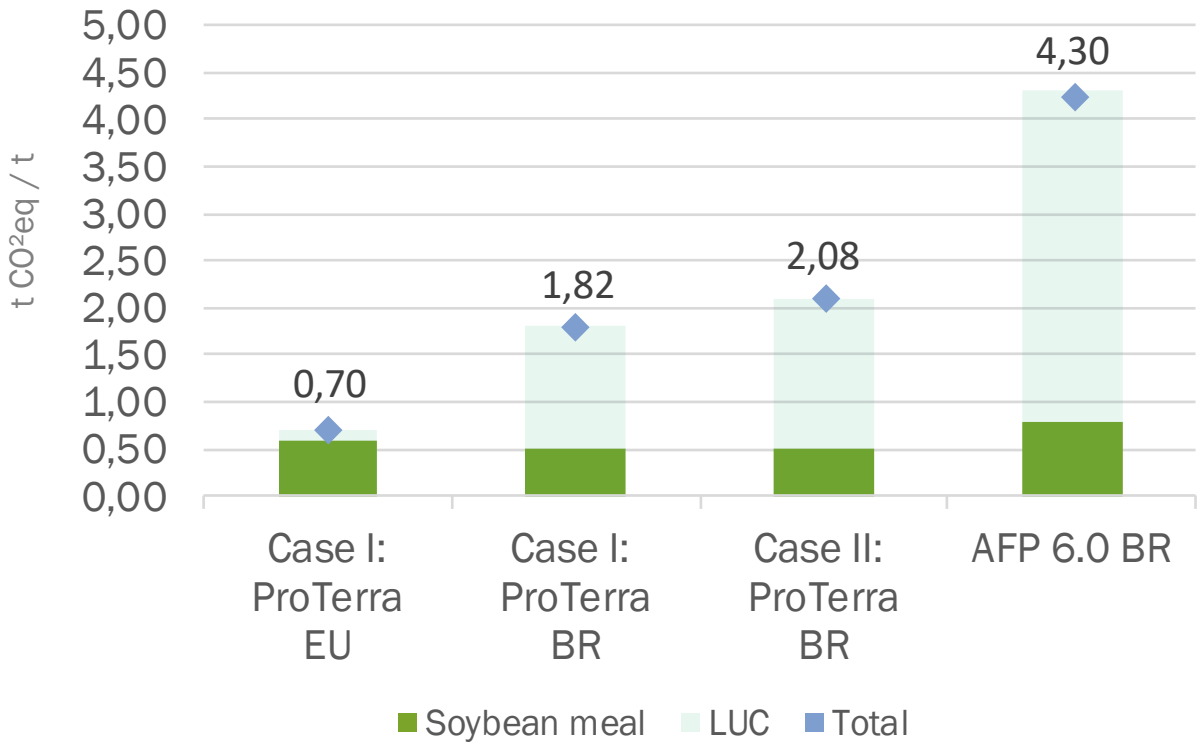
A tonne of ProTerra soybean meal from Brazil and used in Europe:

Case I – EU Carbon footprint	0,70 ton CO^2-eq/ton Soybean meal
Case I – BR Carbon footprint	1,82 ton CO^2-eq/ton Soybean meal
Case II – BR Carbon footprint	2,08 ton CO^2-eq/ton Soybean meal
Water consumption EU	43,69 m^3/ton Soybean meal
Water consumption	0,45 m^3/ton Soybean meal
Land use - EU	3297,68 m^2/ton Soybean meal
Land use - BR	2650 m^2/ton Soybean meal

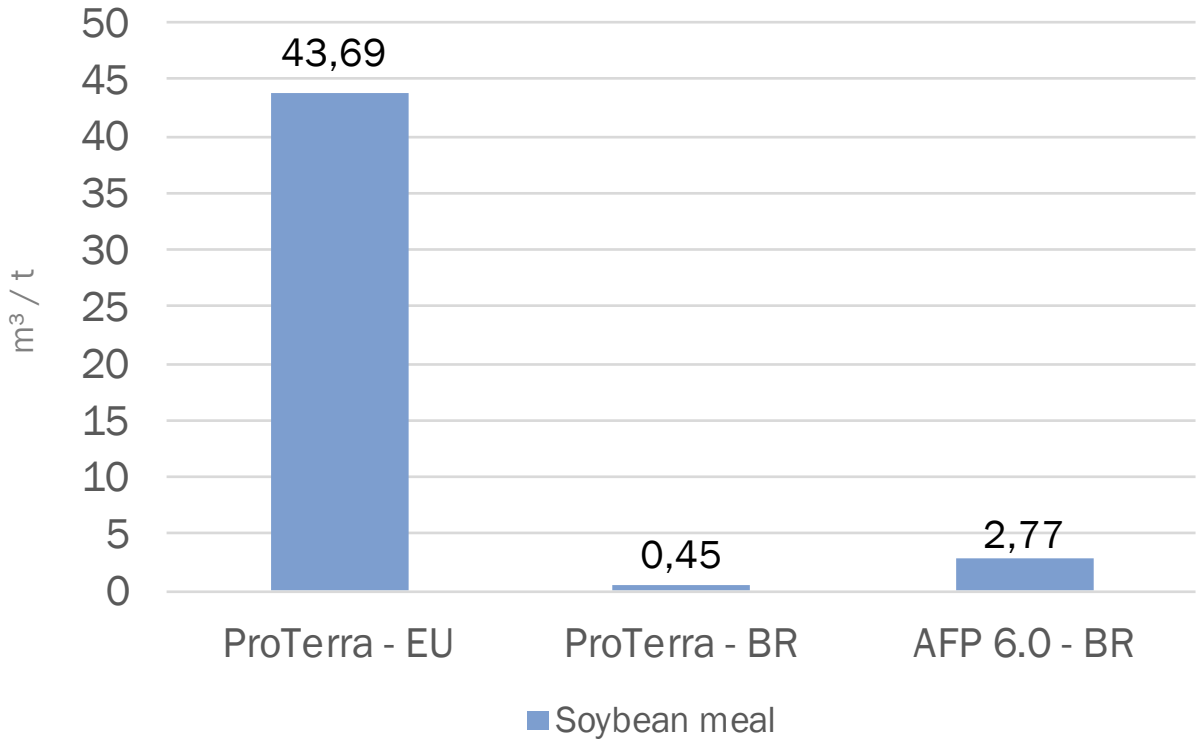
Results in Agri-footprint 6:

Carbon footprint	4,30 ton CO^2-eq/ton Soybean meal
Water consumption	2,77 m^3/ton Soybean meal
Land use	3043,42 m^2/ton Soybean meal

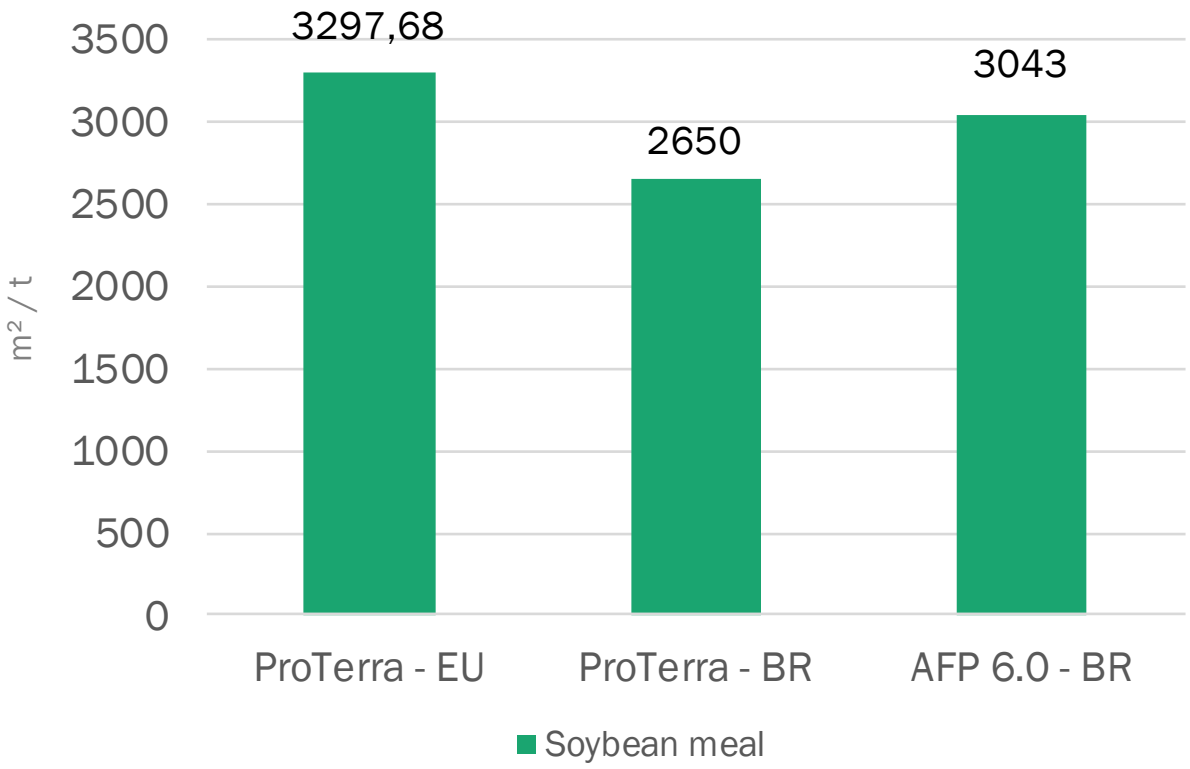
CARBON FOOTPRINT



WATER CONSUMPTION OF SOYBEAN MEAL



LAND USE OF SOYBEAN MEAL



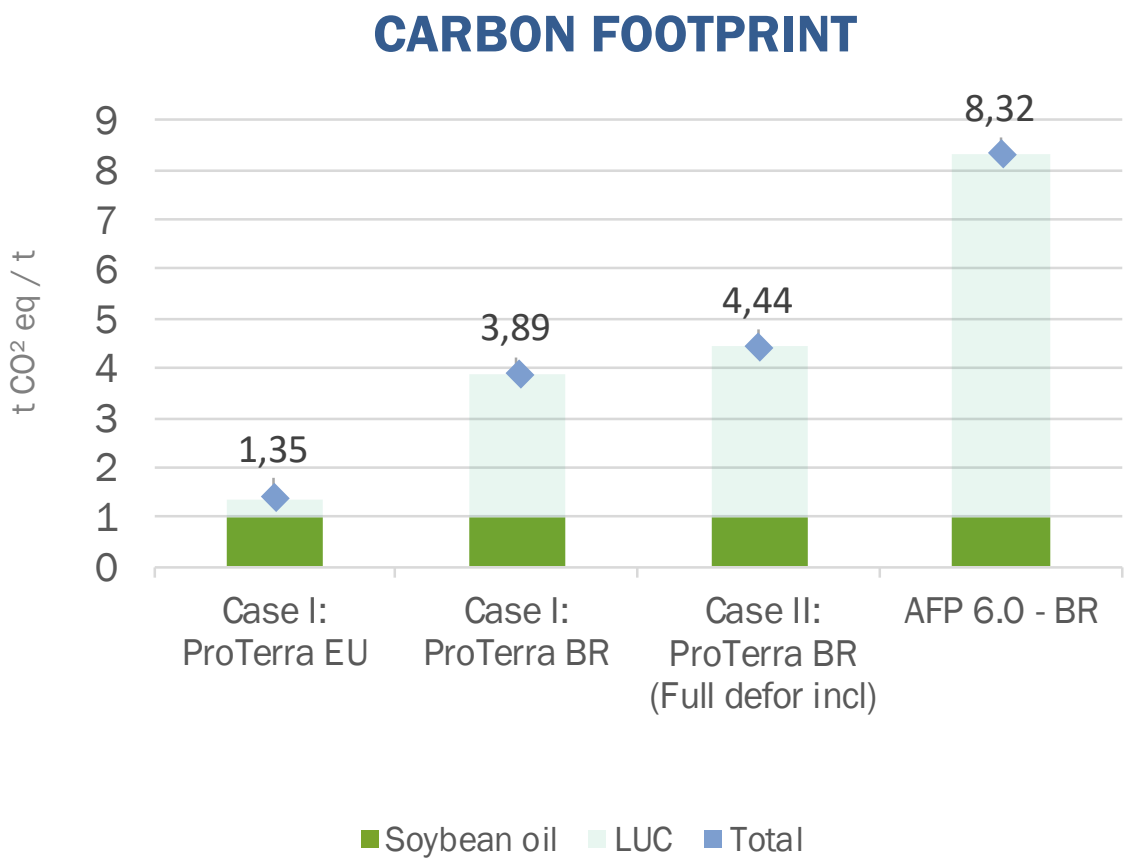
3.4.2 Soybean oil

A tonne of ProTerra soybean oil from Brazil and used in Europe:

Case I – EU Carbon footprint	1,35 ton CO^2-eq/ton Soybean oil
Case I – BR Carbon footprint	3,89 ton CO^2-eq/ton Soybean oil
Case II – BR Carbon footprint	4,44 ton CO^2-eq/ton Soybean oil
Water consumption EU	84,88 m^3/ton Soybean oil
Water consumption BR	0,971 m^3/ton Soybean oil
Land use EU	6401,57 m^2/ton Soybean oil
Land use BR	5730 m^2/ton Soybean oil

Results in Agri-footprint 6:

Carbon footprint	8,32 ton CO^2-eq/ton Soybean oil
Water consumption	5,37 m^3/ton Soybean oil
Land use	5907 m^2/ton Soybean oil



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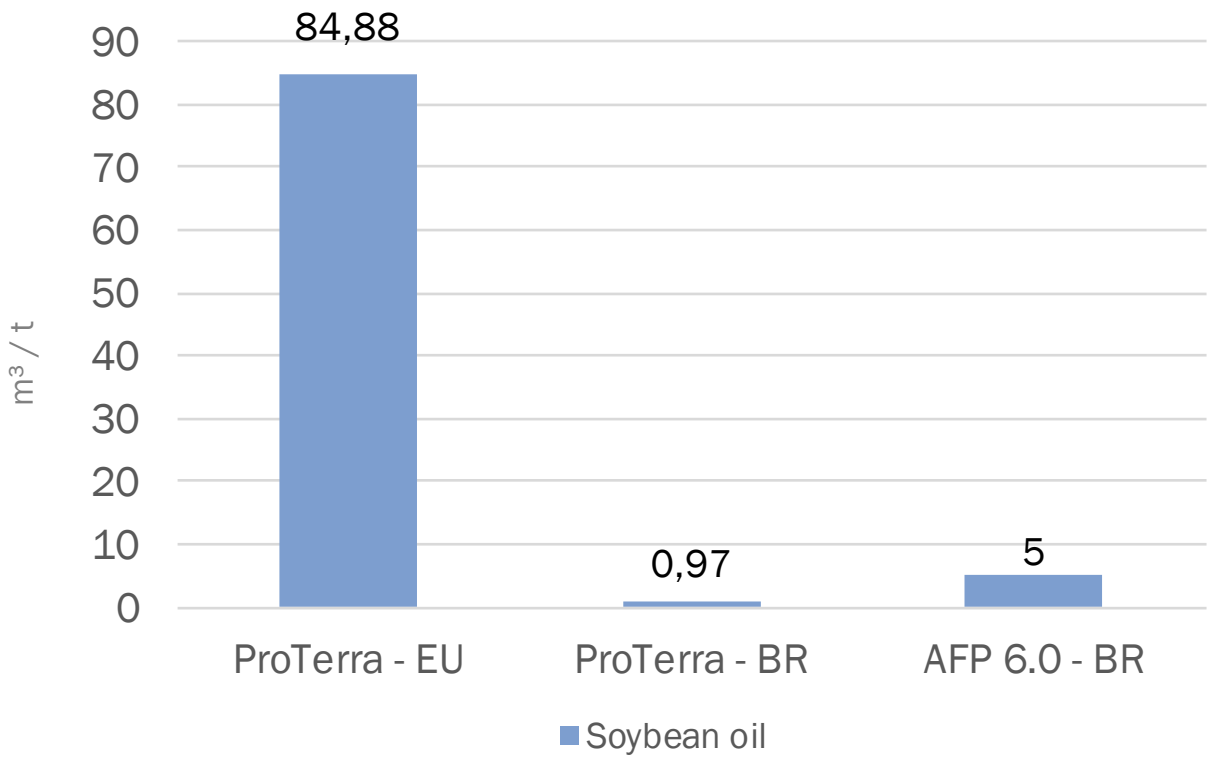
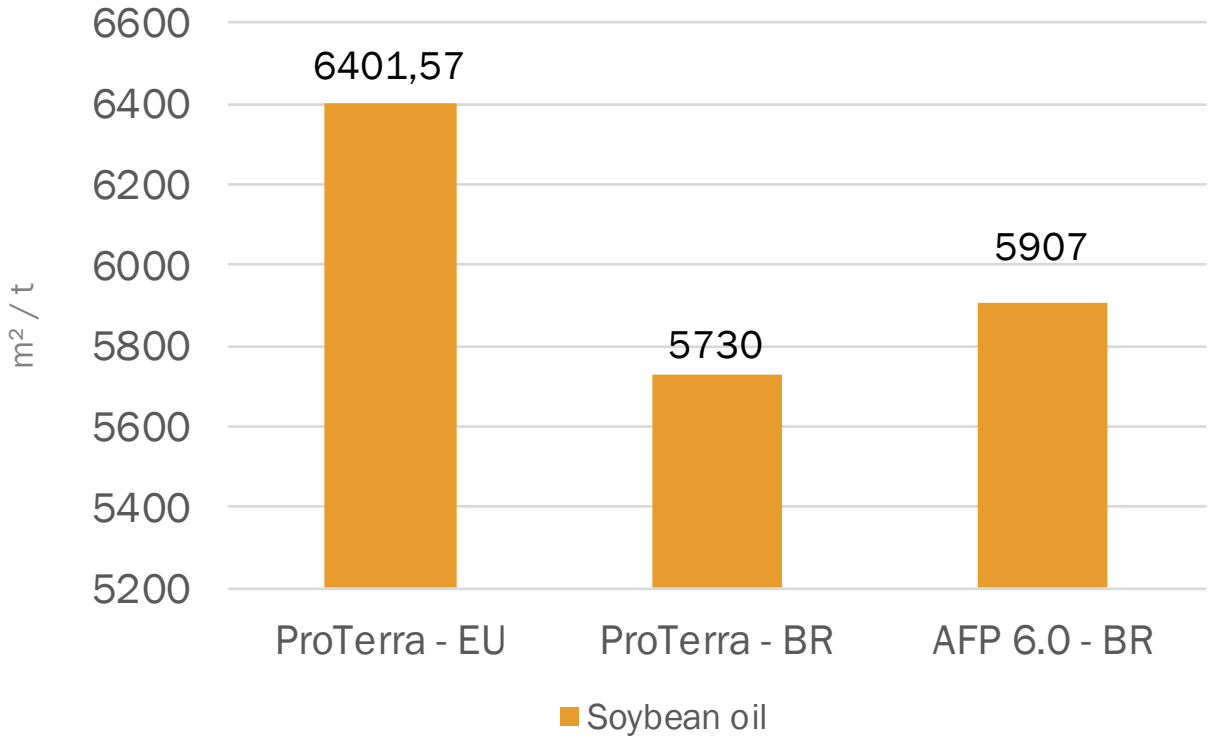


LAND USE



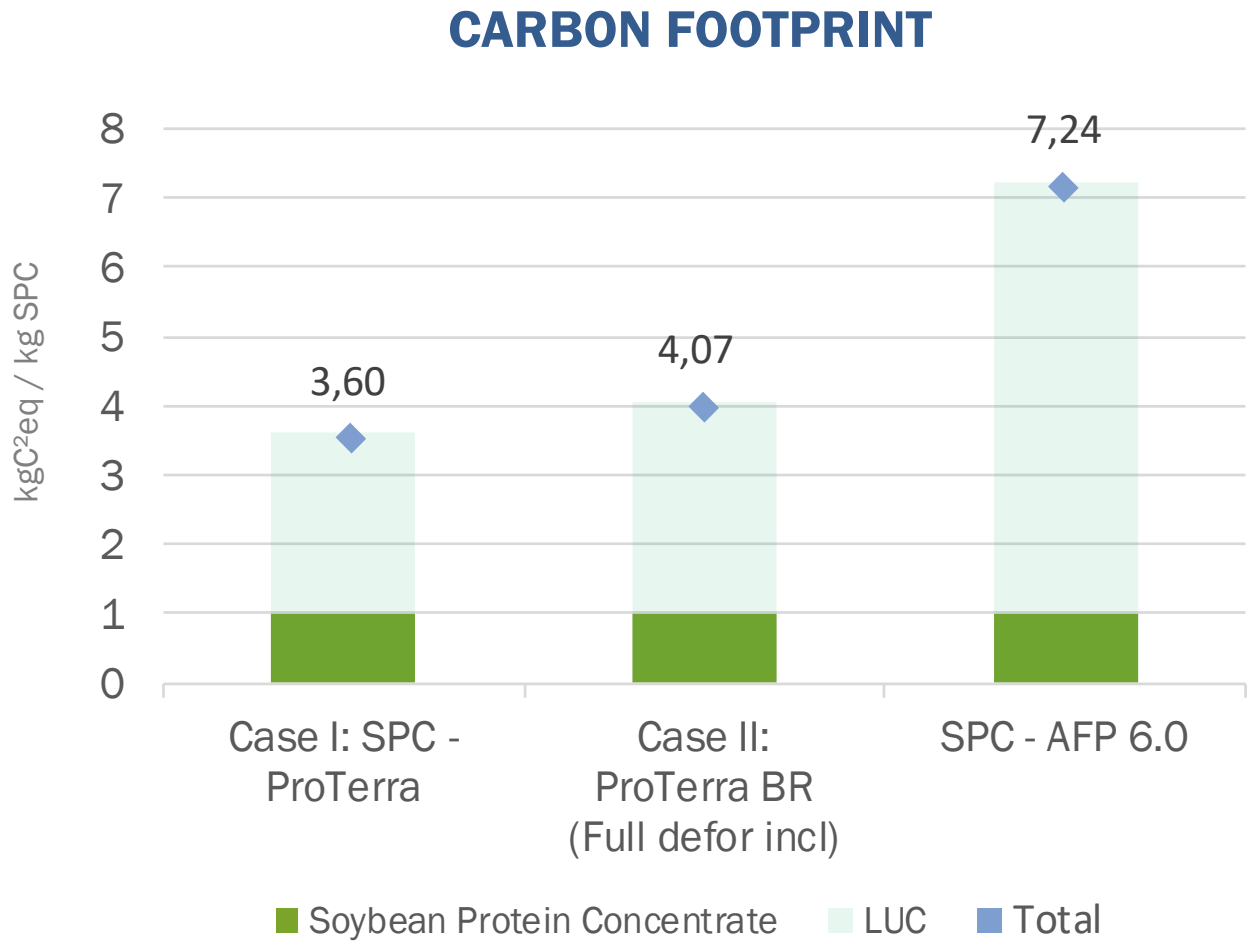
3.5 Soy protein concentrate (SPC)

A kilogram of ProTerra Soybean protein concentrate:

Case I - Carbon footprint	3,60 kg CO^2-eq/kg SPC
Case II – Carbon footprint	4,07 kg CO^2-eq/kg SPC
Water consumption	0,0049 m^3/kg SPC
Land use	4,21 m^2/kg SPC

Results in Agri-footprint 6:

Carbon footprint	7,24 kg CO^2-eq/kg SPC
Water consumption	0,0069 m^3/kg SPC
Land use	4,68 m^2/kg SPC



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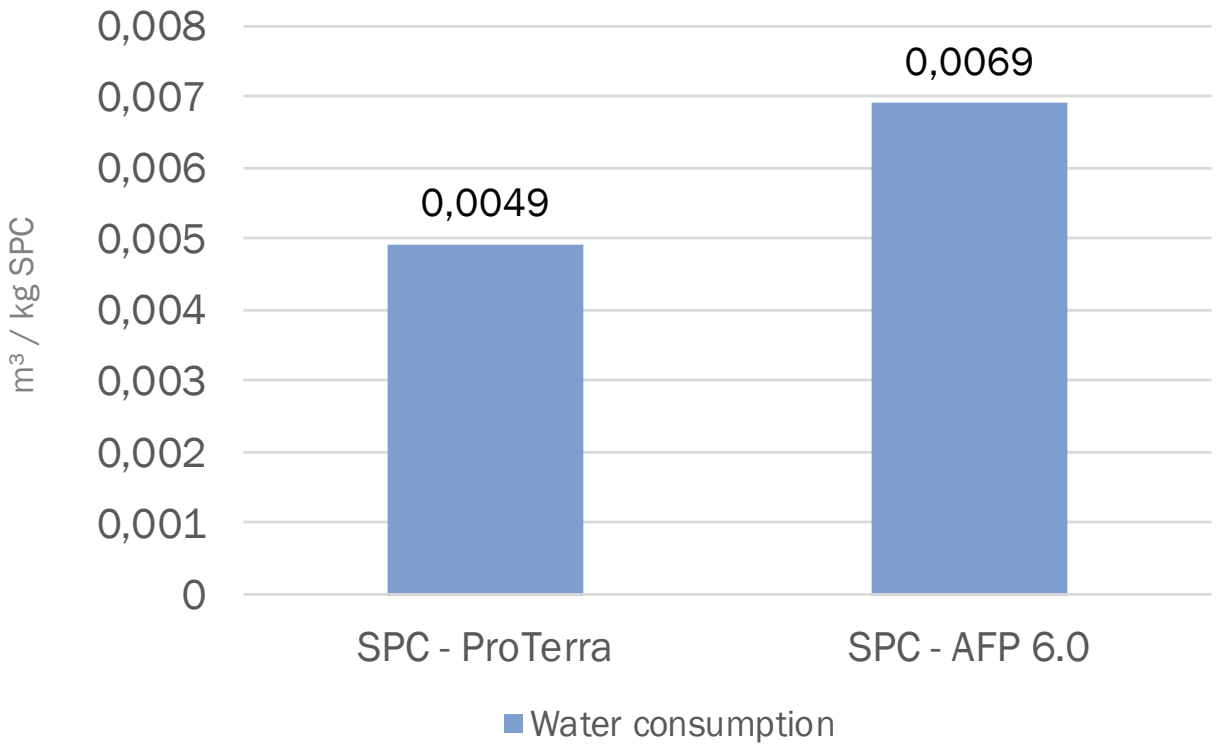
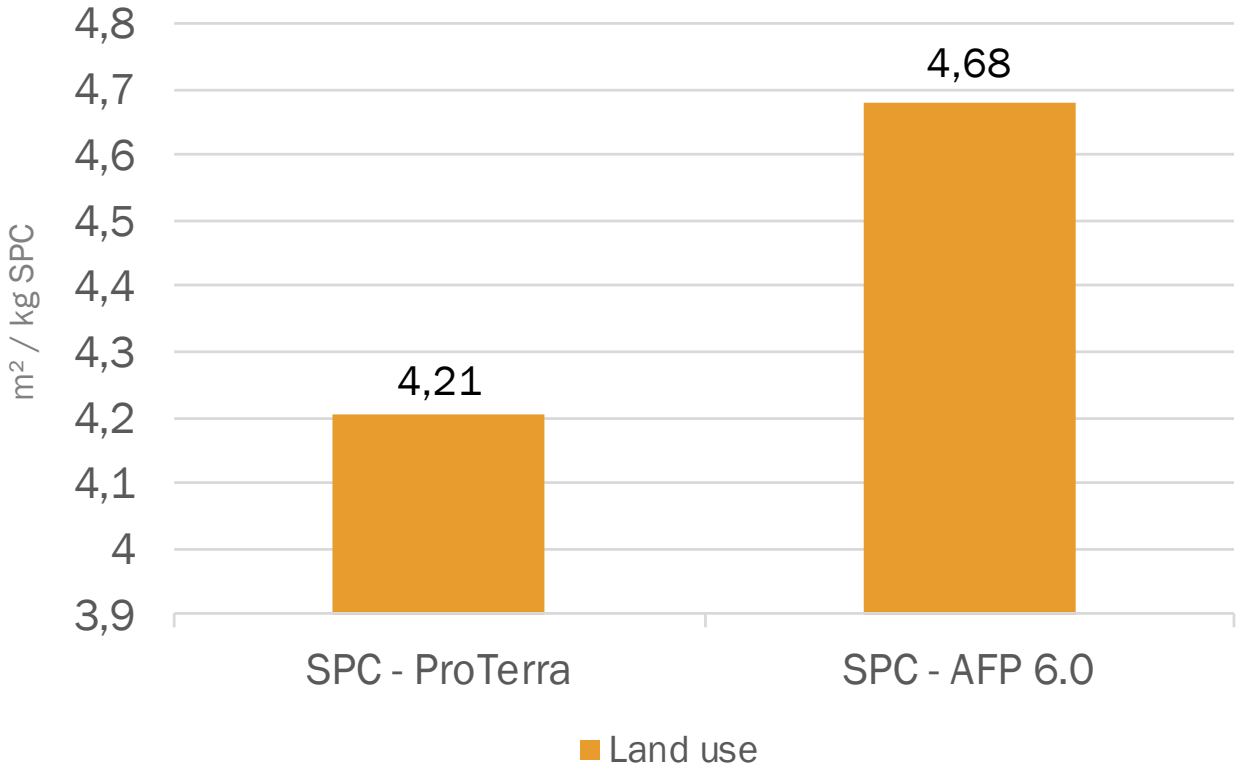


LAND USE



4. Concluding remarks and limitations

- The availability of primary data is concluded as crucial for making accurate calculations. It is acknowledged that in order to make environmental claims, accurate and company-specific data should be used instead of secondary data from LCA databases. It is therefore highly recommended to increase the amount of primary data on ProTerra soybean products, for a higher quality of the outcomes.

- Cautionary Note on Use in Carbon Reporting: Please be aware that this environmental footprint study is not fully compliant to the ISO 14040/14044 or PEF standards.

- (Potential) Customers of ProTerra should be aware of the risk that when shifting from conventional soybean products to ProTerra soybean products cultivated in Europe, pressure on land will increase, resulting in an increase of indirect LUC emissions instead of a decrease.

- Agri-footprint results serve as a reference for comparison, without however allowing for 100% equal comparison due to divergence in the applied data and underlying methodologies. In general, it was shown that the Agri-footprint default results for Brazil are relatively higher than ProTerra results.

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