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Pulses in many forms: what is the more sustainable choice? A case study on brown beans

Perceived sustainability

Pulses can be found in the supermarket in many different forms, like conventional and organic pulses, cooked or dried and also in different packaging like glass, can, plastic etc. This factsheet describes a sustainability assessment of brown beans. An advice on the more sustainable choice will be made by taking into account the agricultural production, processing history and packaging.

Take home message

An advice on the more sustainable choice is made based on quantified sustainability impacts as greenhouse gas (GHG) emissions. Here the AgroChain greenhouse gas Emissions (ACE) calculator was used to estimate impacts, and identify and prioritise hotspots. For agricultural production, the conventional brown beans are expected to have a lower climate impact per kg product than the organic beans, which is mainly explained by the higher crop yield. For packaging, steel cans and glass jars induce higher GHG emissions than Tetrapak and pouches. When comparing dry beans to preserved beans, the dry beans have a lower impact. However, when cooking at home is included, the GHG emissions of dry beans increase significantly and its impact becomes larger than beans in Tetrapak or pouch, but remains lower than beans in glass or can.

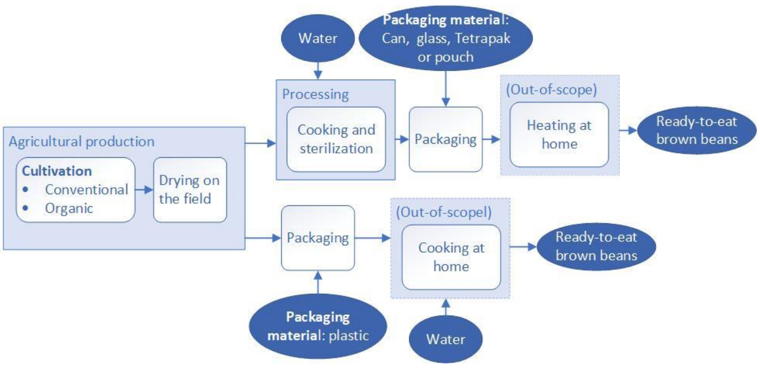

Figure 1: Process chains of brown beans (top) and dry brown beans (bottom) to produce 1kg of ready-to-eat brown beans.

The ACE calculator

*The ACE calculator provides **insights** in the effects of **interventions** on **sustainability** within **boundaries** of the food production and distribution chain.*

The calculator aids in quantification of the environmental sustainability impacts of food processing systems and is able to include a wide range of interventions. Possible interventions include alternative ingredient and sourcing, energy sources, packaging, processing and end-of-life options.
Sustainability indicators: CO_2-eq, energy, water

Case study

The functional unit in this case study is 1 kg of ready-to-eat brown beans, considering the drained weight for preserved beans and the cooked weight for dry beans (both with 30% dry matter). The system boundary covers agricultural production to factory gate (Figure 1). The brown beans are cultivated conventionally or organically in the Netherlands. Transportation from field to factory was out of scope due to short and also equal distances in each scenario. It is assumed that the beans are dried on the field, while preserved beans are further cooked and sterilized in the factory. The packaging material and corresponding weight vary and in this analysis are based on ~250 g beans per package. The dry beans are packed in transparent plastic (0.02 kg/kg dry beans). The beans are packed in a glass jar, steel can, plastic/aluminium pouch (*bonen in zak*) or Tetrapak (*bonen in pak*). The packaging weights (kg/kg beans) are 0.79 for glass, 0.30 for steel can, 0.04 for pouch and 0.07 for Tetrapak. Additionally, the impact of home cooking was calculated for dry beans (60 min) and beans (2 min). Here, 500 g of ready-to-eat beans (equivalent to 180 g dry beans) were cooked at once on a small natural gas burner.

This research is performed within the BO project Sustainable Food Processing in the Netherlands funded by the Ministry of Agriculture, Fisheries, Food Security and Nature (project number BO-43-112-006).

Results

Figure 2 shows the difference between conventional and organic brown beans, both in glass.

- The GHG emissions of organic beans are higher than of the conventional beans because of the lower crop yield of organic beans, assumed at 7.5 ton/ha versus 13 ton/ha for conventional (Bos et al., 2014). Organic beans require therefore relatively more diesel use and other energy use of machinery.
- On the total GHG emissions the contribution of the ingredients is relatively small.

Figure 3 shows the effect of packaging.

- The steel can induces the highest GHG emissions. Although glass packaging is heavier per kg of beans, the higher GHG emissions from steel had a greater impact on total emissions.
- The Tetrapak and pouch appear to have the lowest GHG emissions. The total GHG emissions can be reduced by a factor two when choosing for Tetrapak or pouch instead of a can.

Figure 4 compares the dry beans in plastic with the beans in cans or Tetrapak. The packaging of the beans is not identical, as the preserved beans require a stronger package to withstand the high temperatures of the processing.

- When cooking at home is not included, the GHG emissions of the dry beans are much lower than of the preserved beans.
- With cooking at home included, the GHG emissions of the dry beans increase significantly, with total emissions in between beans in can and beans in Tetrapak. The cooking of the dry beans is time-consuming and is not as efficient as the cooking process of the preserved beans in the factory.

Advise for 'the sustainable choice': which brown beans to select?

This study shows that packaging and processing have the largest impact on the sustainability of the brown beans.

- Tetrapak has the lowest impact in terms of packaging and can cut the overall GHG emissions by half compared to a can.
- The system boundary is important. When cooking at home is included in the analysis, the GHG impact of the dry beans increases significantly, whereas for the preserved beans the impact of home cooking is minimal.
- Conventional brown beans are somewhat more sustainable in terms of GHG emissions than organic beans. Please note that for other crops the sustainability of conventional vs organic can be different.
- For cooking at home, only natural gas was considered. Cooking on electricity will change the GHG emissions, for grey electricity they will roughly double, for green electricity the GHG emissions will be 0. Note that the Dutch grid provides a mix of grey and green electricity.

Please keep in mind that choosing different pulses or changing the composition of packaging may lead to a different outcome. Learn more about our sustainability assessment tools or contact us.

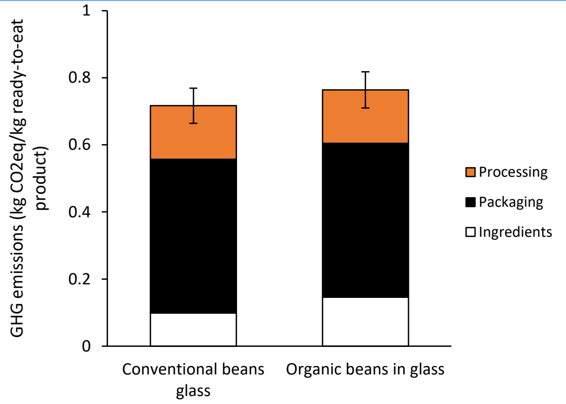

Figure 2: GHG emissions of conventional and organic brown beans in glass.

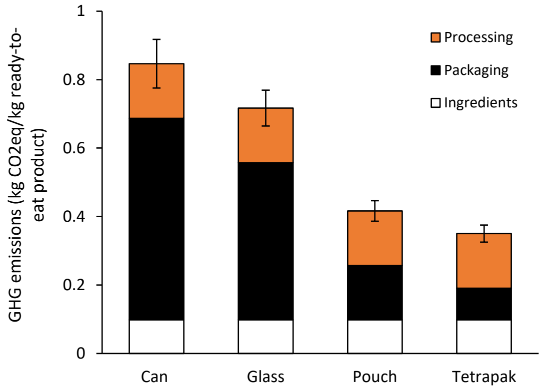

Figure 3: GHG emissions of conventional brown beans in different packaging.

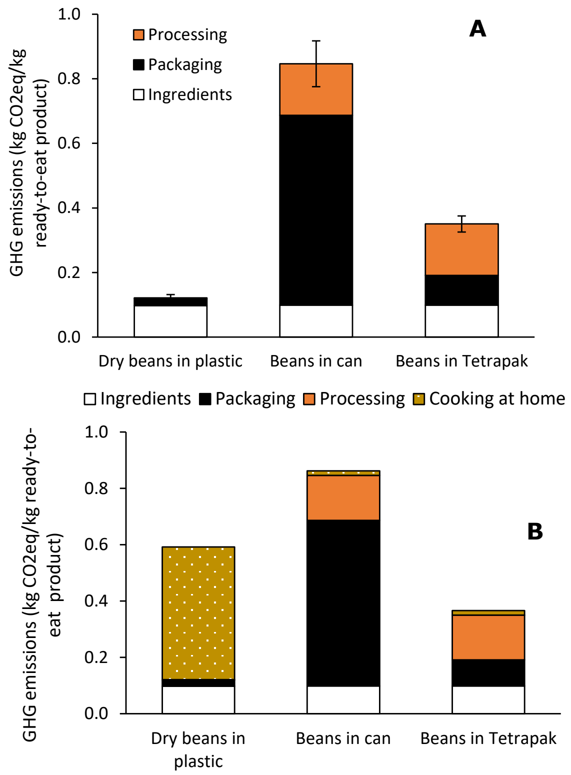

Figure 4: GHG emissions of dry and preserved beans without (A) and with (B) cooking/heating at home.

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