

# Comparison between different sorts of rice for a Swiss household

## Goal and Scope

This poster investigates the differences in environmental impact of different sorts of rice, ready for consumption at a Swiss household. Included are differences in cultivation, transport and cooking time. Not included are differences in irrigation systems during cultivation, because a which may have an impact on the amount of climate gases emitted. Where differentiated data was available, medium values were calculated. All life cycle inventory data can be purchased with the ESU database for food production and consumption [1]. The poster has been elaborated as part of an internship.

## Importance of rice and application in this study

Food production and climate change are two closely interlinked processes. Rice is staple crop for many people. However, rice production also emits both methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), two important climate gases and the rice is often transported quite far. There exist many different sorts of rice, from different origins available in Switzerland.

## Included processes

Background database for the LCI is the ESU-database [1] and the ecoinvent-database [2].

Included in the production stage are rice seed, inputs from fertilizers and pesticides, as well as field processes and direct emissions to air (CH<sub>4</sub>, N<sub>2</sub>O, NO and NH<sub>3</sub>), water (Nitrates, Phosphorus and different pesticides) and soil (different pesticides). In different locations, different kinds and amounts of pesticides are used, which influences the direct emissions. The amount of methane produced during the rice cultivation highly depends on the kind of cropping system and the irrigation system [3]. The transport to the Swiss supermarket (freight ship and/or lorry) and packaging in plastic of the de-husked (brown rice) or milled rice (white rice) are included as well. In the preparation stage the use of water and energy for cooking are included.

## Environmental impacts of different sorts of rice

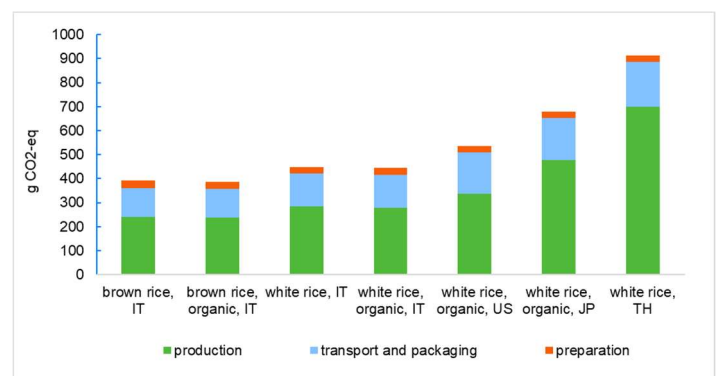
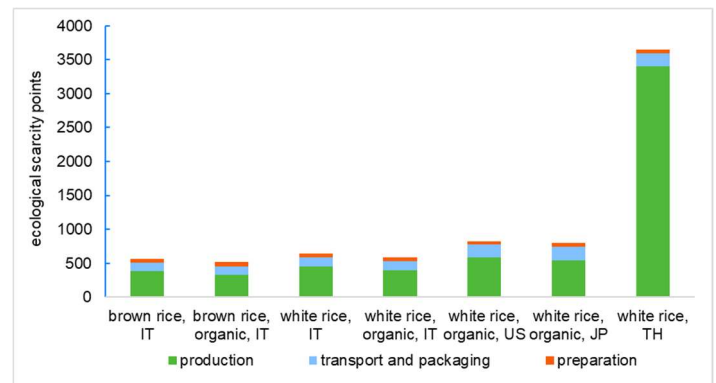
The first graph shows the results in ecological scarcity points, the second graph in g CO<sub>2</sub>-eq. Functional unit is one portion of rice (100 g), cooked, at a Swiss household.

The analysis shows, that the environmentally most important stage from field to plate is the agricultural rice production. Around 70 % of the environmental impact in eco-points or around 65 % in g CO<sub>2</sub>-eq are due to the cultivation stage. This includes all processes until farm gate. The exception is rice from Thailand, where the production stage is even more important (eco-points 93 %, g CO<sub>2</sub>-eq. 76 %). In general, rice from Thailand has a bigger impact than rice from other countries. The difference in eco-points mainly comes from phosphorus which leaks into surface waters. The amount of phosphorus used in Thailand is much higher than in other countries, but this may also be due to different methods of data collection. Also, in g CO<sub>2</sub>-eq. is higher, mainly due to high CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O emissions.

The environmental impact of transport is higher for rice coming from farther away, which need to be transported by freight ship. But, this stage is not

as important as the cultivation stage, the same is true for the cooking. In general, brown rice needs to be cooked longer and has a bigger impact during this stage.

Between organic and conventional cultivation there are only small differences, but in general organic cultivation is slightly better.



## Recommendations for the consumption of rice

This chapter shortly gives some hints on what rice is from the point of environmental impacts to be preferred.

When it comes to the transport, rice coming from a country closer to Switzerland like Italy is to be preferred to rice which need to be transported by freight ship. For the more important cultivation stage, this study shows that rice from Italy may be preferable to rice from Asian countries. A clear statement about this stage is hard to make, because the different data sources for different countries result in uncertainties in comparison, but together with the transport, rice from Italy may overall be better.

Organic cultivated rice has according to the data available less environmental impact than conventional cultivated rice.

Brown rice is not milled, therefore there is less loss over the supply chain and less impact per kg rice. Another positive aspect of brown rice is, that it has more nutrients and is higher in fibres than white rice. <sup>a</sup>

<sup>a</sup> <https://foodoholic.de/brauner-reis-gesuender-als-weisser-reis/>

## References

1. Jungbluth, N., et al., ESU World Food LCA Database - LCI for food production and consumption, 2019, ESU-services Ltd.: Schaffhausen, CH.
2. ecoinvent Centre, ecoinvent data v3.4, ecoinvent reports No. 1-25, 2017, Swiss Centre for Life Cycle Inventories: Zurich, Switzerland.
3. Thanawong, K., Integrated analyses of techno-economic and environmental efficiencies of Hom Mali rice cropping systems in Thailand, 2014.