



Plant-Based Diets

Environmental Benefits of Soy

Environmental-Friendly Soy Protein

- Soy foods are an environmentally-friendly protein source with nutritional and environmental advantages over other protein food sources. Research has shown that the environmental impact of producing proteins from soybeans is low compared to proteins produced from animal sources.

📖 Researchers estimated that it takes 6-17 times more land, 4-26 times more water and 6-20 times more fossil fuel to produce an equivalent amount of protein from meat as it does from protein foods based on soybeans.¹

📖 In terms of Green House Gas Effects (GHGE) and land use of food productions per kg of edible part, soybean requires 75% less land than pork and beef; whereas GHGE produced by beef, pork and egg is approximately 113, 39 and 20 times that of soybeans.²

- Food choices can have great influence on GHG emissions as researchers found that there are dramatic differences in greenhouse gas (GHG) emissions associated with different meals.

📖 Researchers had estimated that a meal based on beef and rice would produce 90% more GHG than a meal based on soybeans and wheat despite the similar protein and energy contents of these meals.³

- In looking at the impact of different proteins on the environment, it's important to also consider protein quality. Soybeans are not only higher in protein than other legumes and grains but the quality of soy protein is much greater than the quality of other plant proteins.⁴⁻⁵

📖 It was estimated that the amount of soybeans sufficient to meet the dietary requirements for the essential amino acids (EAA) require ≈ 85% less land and produce ≈ 90% less GHGE, than those associated from beef.² The environmental impact of soybeans is also the lowest compared to other plant foods, as for other vegetable proteins, large amounts are required to meet with the daily requirement of all the EAA.

Table 1: GHGE & land use of different food products²

Food	Kg CO ₂ eq kg ⁻¹ (edible part)	Land use m ² /kg (edible part)
Beef	25	13.4
Pork	8.6	14.5
Egg	4.3	5.2
Beans	3.27	3.8
Soybeans	0.22	3.3

- Researchers also found that the environmental footprint of plant-based meals could be dramatically reduced when grains are combined with soybeans, as compared to other plant-based food combinations without soybeans.² Additional support for the pronounced environmental advantages of

soybeans in comparison to other plant proteins comes from another study which not only did the researchers show that the production of animal protein results in dramatically higher levels of GHG emissions than plant protein but among the plant foods examined, soybeans were the food that produced the least GHG emission per unit of protein provided.⁶

- Individual soy products are also environmentally advantageous when compared to their equivalent animal products.

 **The carbon footprint of 1 kg of tofu product is 85% lower than that from 1 kg of beef.⁷ GHG emissions from soymilk (0.7-1.4kg CO₂e/L) are also lower than that of cow's milk (1.5-1.9kg CO₂e/l).⁸**

 **The water footprint of soymilk is only 28% of the water footprint of cow milk and the water footprint of a soy burger is only 7% of the water footprint of the average beef burger.⁹**

- Despite the wealth of data emphasizing the environmental advantages of soybeans, there remain some common misconceptions about the environmental impact of soyfoods, as soy production in South America is associated with deforestation. However, worldwide, >85% of the soybeans produced are used for livestock feed.¹⁰ Researchers estimated that halving the consumption of meat, dairy products and eggs in the European Union would result in the use of soymeal being reduced by 75%.¹¹ Therefore, it is in fact ultimately the consumption of animal foods such as meat and dairy products that impacts the rain forest. When soybeans are grown directly as a food source for humans, they represent an environmentally-friendly source of protein.

Conclusions

- Soy is a source of high quality protein with pronounced environmental advantages over other protein food sources, it requires less water and land to produce and emit less GHG than the production of other animal and vegetable protein sources. Shifting from an animal-based diet to a plant-based diet with soybeans could greatly help to lower the environmental impact of the food that we eat.

References

1. Reijnders L, Solet S. Quantification of the environmental impact of different dietary protein choices. *Am J Clin Nutr.* 2003;78:664S-8S.
2. Tessari P, Lante A, and Mosca G. Essential amino acids: master regulators of nutrition and environmental footprint? *Sci Rep* 2016;6:26074
3. Carlsson-Kanyama A, Gonzalez AD. Potential contributions of food consumption patterns to climate change. *Am J Clin Nutr.* 2009;89:1704S-9S.
4. Messina MJ. Legumes and soybeans: overview of their nutritional profiles and health effects. *Am J Clin Nutr.* 1999;70:439S-50S.
5. Hughes GJ, Ryan DJ, Mukherjea R, Schasteen CS. Protein digestibility-corrected amino acid scores (PDCAAS) for soy protein isolates and concentrate: Criteria for evaluation. *J Agric Food Chem.* 2011;59:12707-12.
6. González AD, Frostell B, Carlsson-Kanyama A. Protein efficiency per unit energy and per unit greenhouse gas emissions: Potential contribution of diet choices to climate change mitigation. *Food Policy.* 2011;36:562-70.
7. Sidharta S, Ardiansyah A. ASSESSMENT OF TOFU CARBON FOOTPRINT IN BANYUMAS, INDONESIA-TOWARDS 'GREENER' TOFU. In Proceeding of International Conference On Research, Implementation And Education Of Mathematics And Sciences 2014 2014. Yogyakarta State University.
8. Product Carbon Footprint Summary. Tesco. Issued August 2012.
9. Ercin AE, Aldaya MM, Hoekstra AY. The water footprint of soy milk and soy burger and equivalent animal products. *Ecological indicators.* 2012 Jul 31;18:392-402.
10. Thrane M, Paulsen PV, Orcutt MW, Krieger TM. Soy protein: Impacts, production, and applications. In: Nadathur SR, Wanasundara JPD, Scanlin L, eds. *Sustainable Protein Sources.* United Kingdom: Academic Press; 2017:23-46
11. Westhoek H, Lesschen JP, Rood T, et al. Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. *Global Environ Change.* 2014;26:196-205.



Disclaimer:

This fact sheet by Vitasoy International Holdings Limited is designed for informational purposes only and it is not intended to serve as medical advice. The information provided here should not be used as diagnosing or treating a health problem or disease. It is not a substitute for professional care. Always seek the advice of a physician or other qualified health provider with any questions you may have regarding a medical condition. Never disregard professional medical advice or delay in seeking it because of something you have read on this factsheet. Photocopying this publication in its original form is permitted for educational purposes only. Reproduction in any other form without the written permission of Vitasoy International Holdings Limited is prohibited.

Acknowledgement of contribution: Mark Messina, Ph.D., M.S.
© 2017 Vitasoy International Holdings Limited. All Rights Reserved.