

Indonesian Nitrogen Footprint Assessment of Food Sector

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Abstract

The emission of reactive nitrogen (N) through the food sector is a serious problem for human health and the environment. Indonesia, as an agrarian and populous country, has a high demand for N to provide sufficient food. We calculated the food N footprint in Indonesia, which was assessed from 1961 to 2013. We found that the per capita food N footprint had an increase trend and reached 14.7 kg-N capita⁻¹ year⁻¹ in 2013. Food diets and excess use of fertilizers are the main contributors to the food N footprint in Indonesia.

Keywords: Nutrient management, Sustainability, Food production, Food consumption

1. Introduction

Excessive reactive N in the environment can cause problems such as climate change, soil acidification, and water pollution, which can damage the environment and human health. The food sector contributes the highest portion of reactive N emissions to the environment. Indonesia, a large agrarian and highly populous country, is a major contributor to global food production and consumption. In this study, the food N footprint in Indonesia was assessed from 1961 to 2013.

2. Data and Methods

The total food N footprint was calculated by summing the N footprints of production and consumption. The former was evaluated by multiplying the consumed N and the year-sensitive virtual N factors (VNFs). The VNFs were estimated following the method described by Oita et al. (2020). The data were obtained mainly from the Indonesian food data of FAOSTAT, but additional data and factors were taken from the literature.

3. Results and Discussion

The per capita food N footprint in Indonesia tended to increase during the study period from 4.7 kg-N capita⁻¹ year⁻¹ in 1961. There were notable increases in 1994 (8.8 kg-N capita⁻¹ year⁻¹, 0.5 kg-N capita⁻¹ year⁻¹ increase from 1993) and in 2003 (11.1 kg-N capita⁻¹ year⁻¹, an almost 1 kg-N capita⁻¹ year⁻¹ increase from 2002). The increase aligns with the continuous increase of VNFs of each food and of food consumption (327 kg capita⁻¹ year⁻¹ in 1961 and 461.1 kg capita⁻¹ year⁻¹ in 2013). From 2003 to 2013, the highest contributors to the N footprint were oil crops and seafood. The dietary shift to more animal-based foods and the low N use efficiencies for crop cultivation seem to be the main factors of N footprint increase. Substitution of synthetic fertilizer with organic fertilizer and education about low VNF food diets would help decrease the N footprint.

4. Conclusion

The N footprint of the food assessment in Indonesia showed an increasing trend due to dietary patterns and low N use efficiencies. The results provide impetus for actions to attain nutrient management sustainability by changing fertilizer

usage and educating people to consume more environmentally friendly foods.

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References

Oita A, Wirasenjaya F, Liu J, Webeck E, Matsubae K 2020 Trends in the food nitrogen and phosphorus footprints for Asia's giants: China, India, and Japan *Resour. Conserv. Recy.* **157** 104752