Substituting cereal-based pig feed with grass protein from green biorefinery: is it a economic and environmental sustainable way for agriculture?

Abstract:

Traditional pig production often highly relies on the cereal-based feed, which has adverse effects on the environment, e.g. unsustainable carbon and nutrient flux with cereals production. A promising alternative is to use proteinaceous feed from grass, which is produced at the green bio-refinery (GBR), to substitute part of the cereals. Cultivation of grass on arable land can reduce nitrogen leaching and pesiticide application. The GBR using grass as feedstock also produces valuable byproducts, e.g. fiber and biogas. The residues from production at green bio-refinery can also be fed back to the land as fertilizer with reduced environmental effects. In this study we will use the life cycle analysis (LCA) to analyze the economic and environmental effects of pig feed for producing one ton pork with two feeding systems. The results show that compared with traditional cereal-based feeding system, for producing one ton pork (1) the average feed cost will decrease by 5.01%; (2) the GBR will produce a profit of 96 € before tax; (3) the nitrate leakage (NO_3-N) will decrease by 26.8%. However, in most of the scenarios, the nitrogen emissions into the air will also increase because of the increased N fertilizer applied to the grass production, e.g. N_2O-N and NO_x-N will increase by 8.84% and 8.72%, respectively. In most of the scenarios, the energy and land use will also be saved. However, some important factors, e.g. the soil condition and pressed juice fraction in fresh biomass, could subvert the conclusion about energy and land use saving due to

GBR. Because crop growing practice and pig feed composition are similar in Northern Europe, we suggest the method and results of this study can be applied for the Nordic countries in most of the cases.

Keywords:

Cost-benefit analysis; Environmental effects; Grass juice; Green bio-refinery; Life-cycle analysis; Pig feed