Environmental Impact Assessment of Hydroponically Grown Wheat Green Fodder

Andrius Grigas, Dainius Steponavičius, Aurelija Kemzūraitė\*, Eglė Jotautienė

Department of Agricultural Engineering and Safety, Faculty of Engineering, Vytautas Magnus University Agriculture Academy, Studentų St. 15A, LT-53362 Akademija, Kaunas district, Lithuania

\*Corresponding author. Tel.: +370 37752357; E-mail: [Aurelija.Kemzuraite@vdu.lt](mailto:Aurelija.Kemzuraite@vdu.lt)

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**Abstract**

It is estimated that approximately 70% of all agricultural land is used for livestock production. This represents 14.5% of all human greenhouse gases (GHG) emissions. GHG generated during the animal feed production process account for the largest portion (45%) of these emissions. Needs of animal products for public consumption by using conventional production practices has almost reached its limits. Consequently, new and innovative methods based on modern technologies are becoming necessary to reduce the environmental impact of livestock production. Animal feed production can be considered as one of the leading sources of agricultural GHG emissions. Although promising hydroponic plant production technologies are being developed and improved, their potential impact towards cleaner environment is still a concern.

This study conducted experimental research with the test stand equipped with a nutrient film technique (NFT) system for hydroponically grown green fodder. Based on the fodder yield data obtained in the laboratory, mathematical modelling was performed to predict the potential for industrial fodder production. The aim of this study was to evaluate the impact of different growing cycles (5–11 days, inclusive) on wheat fodder yield, nutrient content (crude protein, ether extract, crude fibre, ash and nitrogen free extract) and environment through Life Cycle Assessment (LCA). Global warming potential for carbon dioxide equivalent (CO2eq) was assessed using SimaPro 9.3 simulation software and the Ecoinvent 3 database by the implementation of the CML-IA baseline LCA method (v3.06).

The results of this study showed that the yield of wheat fodder using 6-day growing cycle was the highest − 28.37 t month−1. Meanwhile, the results of LCA indicated that the hydroponic fodder from the 11-day growing cycle had the least impact on the environment (106.18 kg CO2eq t−1 of fodder). However, in order to achieve not only a sustainable but also an efficient hydroponic fodder growing system, it is still appropriate to choose a 6-day growing cycle where the ratio of yield (28.37 t month−1) and environmental impact (122.47 kg CO2eq t−1 of fodder) was the highest. Based on the results, it is also recommended to choose a 6-day growing cycle for the higher amounts of nutrients and for reducing the environmental impact in hydroponically grown wheat fodder production.