Is it possible by using Biogas to make organic agriculture CO2 neutral – and will it have influence on the content of humus in the soil?

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Anaerobic digestion (AD) of animal wastes, crop residues and dedicated energy crops, and the use of the digestates as manure in organic farming is a widely discussed option to improve nutrient use efficiency in organic farming systems. The expectations on AD are (i) a higher N availability in digestates, (ii) lower N losses via nitrate leaching risk, ammonia volatilization and nitrous oxides, (iii) lower greenhouse gas emissions, (iv) substitution of fossil fuels, and (v) alternative use-pathway for leys, grassland, etc. However, in organic farming there are concerns regarding the long-term effects of AD on soil fertility, soil biological activity and preservation of soil humus, as soil organic matter is considered to be a key attribute of soil fertility in organic farming. In the last few years a lot of experiments have been carried out to assess the effects of AD on farm productivity and soil properties.

For stockless organic farming systems, experiments carried out in Germany and in Sweden indicates that AD is a tool to get mobile manures, leading to significant increase of yields and N uptake of non-legumes and simultaneously to a reduction of the nitrate leaching risk and of the soilborne N2O-Emissions. The driving forces are (i) enhanced N-Inputs via BNF, (ii) better allocation of nutrients in space and time (e.g., higher allocation of available manure-N towards non-legume crops), (iii) allocation of nutrients in spring when crop N demand arises. However, digestion of animal slurry has no effect (surface banding) or only a little effect on yields and N efficiency after incorporation immediately after spreading, due to higher ammonia volatilization after surface banding.

Digestion of animal wastes reduces significantly the total greenhouse gases emitted by farming operations, by reducing GHG emissions during manure storage and by the credits obtained due to the replacement of fossil fuels. Digestion of animal wastes means that only a minor part of the total organic matter available in a farming system is incorporated into the biogas plant, therefore the effects on the total soil organic matter inputs are negligible. Furthermore, AD leads to a stabilization of the organic matter in organic manures, enhancing their ability to preserve soil fertility.

Under semi-artificial conditions AD affects soil biological activity; however no effects of AD on soil biological activity under field conditions have been found.

It can be concluded that AD affects nutrient use efficiency only if digested animal manures are incorporated immediately, or when crop residues and cover crops are digested in spite of using it as green manures (more focused N allocation, higher N Inputs BNF). AD of animal wastes do not affect nitrate leaching risk, significant effects have been found only after cover crop or clover grass harvesting. Significant effects of AD on soil properties (humus, biological activity, etc.) are expected only where implementation of AD is combined with strong changes of the entire cropping system (e.g., crop rotation). Therefore, AD can result in a win-win situation in organic farming systems, enhancing the crop yields by a better allocation of nutrients, incorporating a new product from the available residues (energy), and enhancing the GHG balance.