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Bestimmung von Qualitätsparametern für Biogassubstrate - Entwicklung eines Models zur Berechnung des Methanertrages von Silomais *Zea mays L.* und Grünlandschnitt –

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Summary

With the aim to develop a model for the prediction of the specific methane yields from corn and grasslands, from 2007 to 2009 different samples of corn and grass had been taken on different locations in Baden-Württemberg, Germany. These samples have been analysed according to VDLUF A-guidelines for their raw nutrients and with the Hohenheimer Biogas yield test for their specific methane yields. The data showed a good distribution for all relevant parameters. With these results first of all the available models had been evaluated. The evaluation of the models showed no good results. Therefore different models for the prediction of the specific methane yield from the raw nutrients have been developed. The investigations showed, that the method of multiple linear regression was not suitable for the purpose of methane yield prediction, due to the complexibility of the process of biogas production. Therefore for fresh corn a new, exponential model type has been developed. The final model considers the proportion of crude starch and lignin content as predictor for the methane yield. This proportion is fitted to a non-linear function type. The quotient of the crude starch to the lignin content is used as a variable for a function, that goes as an asymptote to a maximum value of O.38 Nm^3/ kg oDM. The model was able to explain 50 % of the variance of the methane yield within the data. The developed exponential model delivers a new approach for the calculation of biogas yields from fresh corn. But a further development of the model with new data and, if necessary, a new interpretation of the data, is required.

For grass samples no satisfying model could have been developed. These samples resulted in a multiple linear model using the parameters crude fibre, crude protein and crude sugar. Due to the small number of samples the developed model is not considered to be representative. Since grass lands differ strongly in their constitution due to different cutting intensities and regional distinctions,

very large sample amount will be needed, to reflect these differences in constitutions. The used data here don't show the required variability for modelling the methane yields.

To find other parameters to define quality of biogas substrates, the influence of the single parameters on the methane yield has been investigated. All parameters show some correlation with the methane yield, but only a few showed a positive correlation. The correlations of the data showed a significant influence of the crude starch content on the specific methane yields for the corn samples. The minimum crude starch content should be 32 % in the dry matter. Furthermore a minimal dry matter content of 32 % of the fresh matter should be reached for a optimum methane production. Samples harvested in an earlier development stage showed a significant reduction in their methane yields. For grass only the crude sugar content showed a significant influence on the specific methane yields of the samples.

Since the prediction of methane yields of corn was the aim of this work, and starch represents one of these parameters, further investigations were carried out to look for technologies that are able to measure these parameters cheaply and fast in a reliable way. Therefore with near infrared reflectance spectroscopy has been tested. The crude starch content could have been measured with a deviation of 2 % of the dry matter content.

So we have a fast and reliable technology for users working with biogas substrates, to determine the quality of the substrate and due to this having the opportunity to make optimum silages.