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Burbi, S; Baines, R. and Conway, J.

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IMPROVING LIVESTOCK FARMER PRACTICES AND ATTITUDES IN ORDER TO REDUCE GREENHOUSE GAS EMISSIONS AT THE FARM LEVEL

S. Burbi, R.N. Baines and J.S. Conway

Royal Agricultural College, Stroud Road, Cirencester, Gloucestershire, GL7 6JS, England

INTRODUCTION

The Climate Change Act of 2008 set the target of reducing the overall greenhouse gas (GHG) emissions by 80% by 2050. The initial phases of the GHG Action Plan for the agricultural sector involve updating gases inventories and reviewing implementation strategies to mitigate emissions (NFU, 2011). Science-based evidence on emissions covers a wide range of mitigation options, but measurements and system boundaries for Life Cycle Analysis (LCA) models are not always standardised or uniformly defined. Carbon calculators like CLA CALM (2009) and cPlan (Coulter and Coulter, 2009) are free and use science-based evidence, but provide different results from common data inputs, making it difficult to assess which findings better reflect the actual conditions on farms. This study aims at supporting the Action Plan by developing a practical approach to GHG mitigation, considering scientific data and socio-economic implications. It will provide valuable information on farmers' perception of mitigation strategies, their sustainability, strengths, limitations and implications for policy makers.

MATERIALS AND METHODS

This study focuses on manure management as an example of the wider PhD research. Mitigation strategies involve diet manipulation, housing, grazing management, manure storage, treatment and application to soil. The initial desk study reviewed the most recent quantifying data on mitigation options to reduce losses as ammonia (NH_3), nitrate (NO_3^-), nitrous oxide (N_2O) and methane (CH_4), to compile a database with a range of emissions. The following steps include a review of carbon calculators available for British agriculture, a review of LCA models and farmers engagement strategies. A decision tree tool will be tested on a pilot set of farmers within a 100 miles radius from Cirencester, Gloucestershire. Farms involved will be, in order of importance: dairy, pig, poultry, beef and clusters of sheep farmers in the South West and in Scotland. Their carbon footprint will be verified using the CLA CALM and cPlan calculators. Workshops will be carried out on reducing emissions, retesting farms at 6 and 12 months to assess changes in emissions and farmers practices. Farmers will be interviewed on the application of the tool, their attitude to climate change and mitigation strategies.

RESULTS

Given the large body of evidence analysed, this report only cites a brief summary of the ranges of emissions for N_2O, NH_3 and CH_4. Reduced crude protein (CP) intake in dairy cows lowers NH_3 emissions by up to 36.5% (Arriaga et al., 2010a). In fattening pigs on deep litter, low CP increases NH_3 losses by 26.1%, CH_4 losses by 12.8% but reduces N_2O losses by 50.9% (Philippe et al., 2006). Low forage / high concentrate diets in cattle reduce the total N-excretion by 8.9% (Arriaga et al., 2010b). NH_3 emissions decrease by 23-80% with different slatted floors (Hamelin et al., 2010), 14% flushing floors with water, 50% using water and formalin (Misselbrook et al., 2006) and 46% removing the manure every 2-3 days (Lachance et al., 2005). Slurry N_2O losses increase with aeration and surface crust, but decrease by 50% with straw addition to manure heaps. After

slurry separation, N_2O losses are lower from the liquid fraction, but higher from the solid one. Emission factors from manure application to soil vary significantly (0.01-0.2 for N_2O; 0.01-43.18 for NH_3) depending on manure type, soil type, temperature, soil moisture and application methods. Strategies to reduce CH_4 emissions are frequent slurry removal (40% reduction), slurry separation (35%), straw addition (45%) (Chadwick et al., 2011).

DISCUSSION

The initial study confirmed that the range of emissions can vary significantly based on a number of factors: diet, housing (building and management), manure storage, treatment and application to soil. Uncertainty cannot be avoided (i.e.: manure and slurry cover). However, there is enough scientific data to support the most effective practices to reduce emissions from manure and therefore to assess their socio-economic impact.

CONCLUSIONS

Key areas where farm practices can reduce emissions have been identified. These will be the focus of the following step to test the decision tree tool that will help farmers identify possible changes in practices. Results will provide valuable information to support the GHG Action Plan for the agricultural sector.

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