RP2008
WASTEWATER BIOSOLIDS – GREENHOUSE GAS EMISSIONS AND SOIL CARBON SEQUESTRATION (SOUTH AUSTRALIAN CASE STUDY)

Research Questions

1. ***Is the First Order Decay (FOD) model for land disposal of solid waste suitable for quantifying emissions from stockpiled biosolids with regards to nitrous oxide (N_2O) and methane (CH_4) emissions?***
2. ***Is there significant and prolonged carbon build-up in agricultural soils from the current rates of biosolids application?***

Methodology

1. GHG emissions (N_2O and CH_4) were quantified via direct measurements and compared to values estimated by the model. Direct measurement was with the static chamber method adapted from soil sciences. Samples were analysed via gas chromatography.

Figure 1: Static chamber and gas sample tubes.

2. Soil samples were taken from broadacre farmland applied with different amounts of biosolids. The sampling method utilised was grid-patterned soil coring to a depth of 30 cm. Reference was made to CSIRO methodology and current Emissions Reduction Fund legislation. Samples were analysed via dry combustion.

Figure 2: Collecting soil samples.

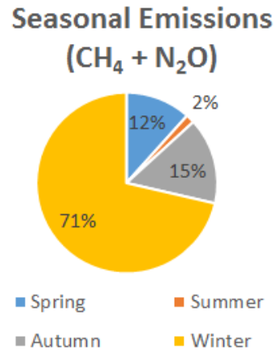
This work is in the final stages of completion. All sampling has been completed and samples analyses is nearing completion. Data analysis is ongoing and **results shown here are not yet final subject to comprehensive statistical analysis.**

Preliminary Results

Note: These values will change slightly once final calculations are completed in 2017.

1. GHG emissions
   a. For a 33,000 dry tonne stockpile, the current GHG model predicted CH_4 emissions of 3,275±35% tonnes CO_2-equivalence vs. data of 1,881 tonnes CO_2-equivalence (74% overestimate).
   b. The model assumed zero N_2O emissions whereas data showed 20,983 tonnes CO_2-equivalence.
   c. Most emissions were produced in winter (71%) and only minor emissions resulted in summer (2%).

Figure 3: Seasonal variation in emissions.



2. Soil carbon
   a. From the data, it is highly unlikely that current biosolids application rates (5 dry tonnes/ha) on farms will result in significant carbon sequestration.

Paddock	Soil type	Cumulative biosolids application (dry tonnes/ha)	Soil organic carbon levels (%)	Standard deviation (%)
132	Tenosol	13.00	0.56	0.03
21	Tenosol	15.00	0.68	0.06
139W	Sodosol	16.30	0.62	0.09
139E	Sodosol	10.50	0.94	0.03
139M	Sodosol	7.50	0.65	0.06
141BM	Sodosol	12.10	0.57	0.06
141F	Sodosol	10.50	0.81	0.05

Table 1: Soil carbon data. As can be seen, there is no noticeable variation in soil organic carbon levels between the highest (blue) and lowest (red) biosolids applications.

Conclusions

1. ***The FOD model underestimates nitrous oxide (N_2O) and overestimates methane (CH_4) emissions from biosolids stockpiles.***
2. ***There is no significant and prolonged carbon build-up in agricultural soils from the current rates of biosolids application***

Anticipated impacts

The results of this research is expected to affect the future planning and management strategies of partner utilities for handling biosolids. Additionally, there is need to develop a better model for quantifying biosolids stockpile emissions as the current FOD model predictions is inconsistent with real-world emissions.

Further information

http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2008-wastewater-biosolids

Contact

Name:

Chin How GOH aka Norman GOH

Organisation:

University of South Australia

Email:

gohcy019@mymail.unisa.edu.au