The BioRich Pilot Project

Supported by the Soil Association and the Centre for Agroecology, Water and Resilience

Innovative farmer, **Richard Copely**, wanted to conduct some research with his beef herd to find out what benefits could be realised by adding his homemade biochar to their diet. Would their health and quality of their manure improve such that there would be less reliance on chemical intervention and more benefits to using their manure as a soil improver?

Through the Innovative Farmer programme, administered by **Jerry Alford** at the Soil Association, Richard was put in touch with Donna Udall of the Centre for Agroecology, Water and Resilience (CAWR) at Coventry University.

Donna Udall helped Richard design a simple pilot study involving 9 Shorthorn cross Limousins. Each cow was given 20g of biochar every day for a week and the manure samples collected and analysed.

Methodology

Richard produced his own biochar from native hard and soft woods sourced from his tree surgery business. These woods were pyrolysed in his Exeter Retort, ground to less that 2mm and bagged into 20g bags.

From the 14th May 2018, Richard fed 9 heifers 1 bag of biochar every morning for 7 mornings. Manure samples were collected on the 14th (prior to feeding) and every morning thereafter for 9 days, placed in a plastic bag, tied and labelled. It was not noted which cows samples were collected from. Donna had collected all samples by day 10.

The samples were stored in a fridge (4°C) until analysis. Four methods of analysis were undertaken; dry weights, ammonia volatilisation and ammonium and nitrate content to establish if the addition of biochar to diet had any effect on these parameters.

1. Dry weights were established for all samples by drying in an oven at (80°C) for 24 hours until weight stabilised.
2. Ammonia volatilisation analysis. 40 g of all samples (4 replicates) were placed in a 250ml bottles with an acid trap placed in the screw top and sealed. The acid trap comprised of polyurethane foam pre-soaked in a solution of 10% phosphoric acid and glycerol. The acid traps captured any ammonia volatilised off the sample for a period of 24 hours and then 1 week. The foam acid traps where then removed and placed in 100ml of 2 molar potassium chloride (KCl) solution and shaken for 1 hour. The extract was then filtered through Whatman. No.1 filter paper and analysed in a continuous flow analyser (FOSS Fiastar).
3. Ammonium content analysis. 20g of all samples (4 replicates) were placed in 250ml bottles along with 100ml of 2M KCL. This was then shaken for 1 hour and the extractant filtered through Whatman. No.1. This was then analysed for ammonium in the continuous flow analyser.
4. Nitrate content analysis. As above but analysed for nitrate in the continuous flow analyser.

Results

1. Dry Weights.

Over the duration of a week it was not possible to discern if biochar inclusion had an effect on dry weight of manure.

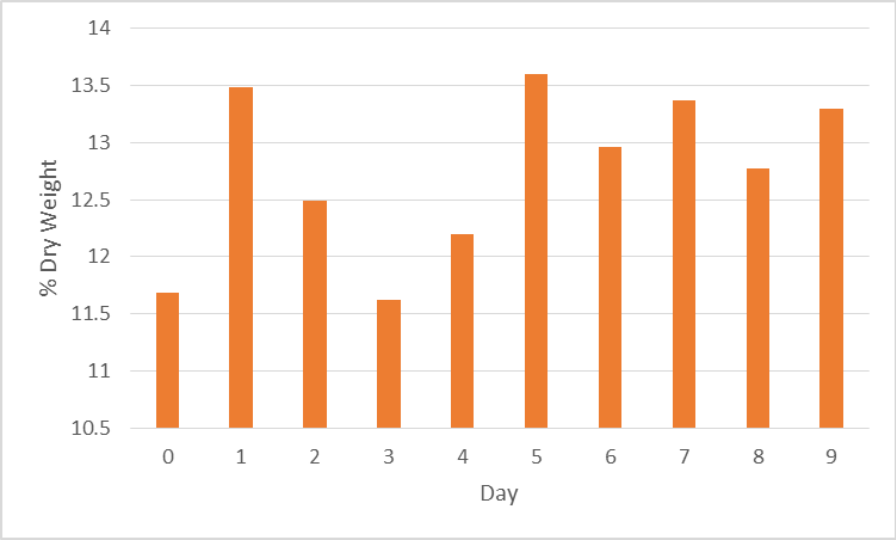

Figure 1. % Dry Weight of manure samples

2. Ammonia Volatilisation

It was expected that with increasing amount and duration of biochar in the cows' stomach it might act to adsorb ammonium and therefore limit ammonia production from cow pats. However, and again, with the experiment only running a week, it was not possible to discern an effect and it was felt that any differences in emission may have been more to do with the collection of samples from different cows.

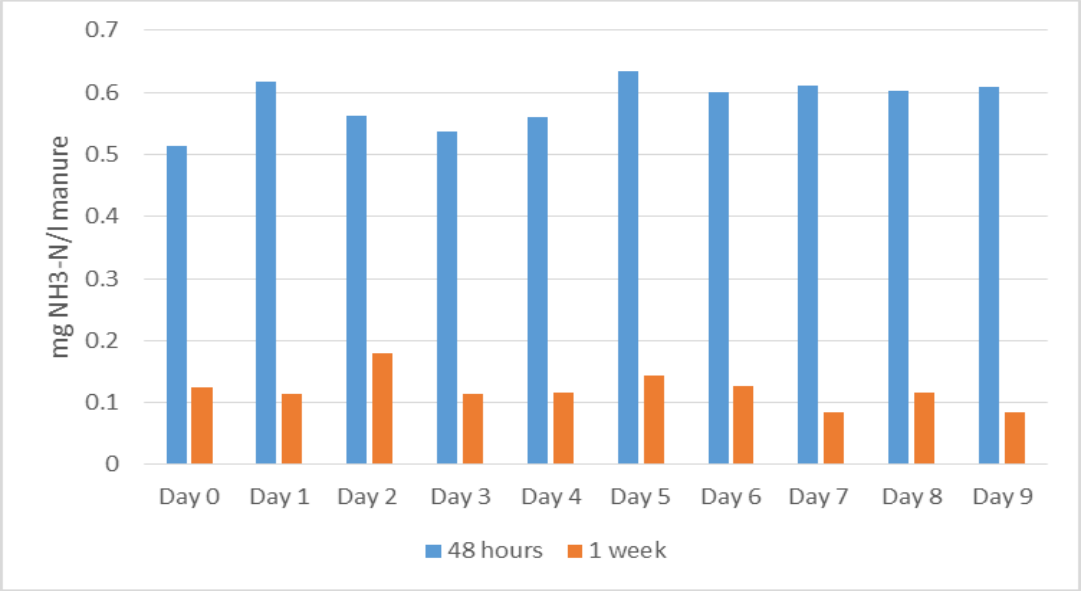

Figure 2. Ammonia volatilisation NH_3-N mg/L manure

3. Ammonium Content

As above, an increase in ammonium content with biochar addition in manure was not evident.

4. Nitrate Content

Nitrate was not detectable in any manure samples but this was as expected.

Conclusions and Suggestions for Future Work

The expectation is that ingested biochar may have an effect on ammonia emissions from manure and, correspondingly, ammonium levels in manure was partly based on successful studies using digestate rather than manure (to be published). This expectation still remains because it was felt that not enough biochar was not administered for long enough. There is also anecdotal evidence that, after 4 weeks of ingesting biochar, manure emissions do fall (Gerlach and Schmidt, 2014). Hence, it is felt by scientists at CAWR, that despite the results of this pilot, a more substantial trial would be worth attempting to secure funding for. The lessons learnt from this very useful pilot are;

1. Undertake an initial methodological study at one farm, collecting from the same cows to investigate underlying variability of ammonia emissions.
2. Undertake a study with a smaller number of animals (suggest 4 with biochar and 4 without) and collect all manure samples and store in airtight containers in timely fashion.

a. To run the study for at 28 days and consider increasing the dosage of biochar.
b. To run the study on both beef and dairy stock, organic and conventional (4 potential farms have been identified for this).

3. Analyse for; ammonia volatilisation, manure ammonium levels, dry weights and worm burden (using FECPAK).

References

Gerlach A, Schmidt HP: The use of biochar in cattle farming. *The Biochar Journal* 2014, Arbaz, Switzerland. ISSN 2297-1114 www.biochar-journal.org/en/ct/9. Version of 01 th August 2014.Accessed: 06.07.2018