

Improving the nitrogen efficiency of poultry litter

GREG BUTLER, SANTFA R&D

The use of poultry litter in place of synthetic fertiliser has been quite successful for a number of farmers.

However, the predominant form of nitrogen in poultry litter is ammonia, which tends to be quite volatile, so much of the nitrogen in litter can be lost to the atmosphere during transport of the litter from the poultry shed to the paddock.

In the 2010 scientific paper titled 'Reducing nitrogen loss during poultry litter composting using biochar' (Steiner *et al.*) reported that adding 20% biochar to 80% litter reduced nitrogen loss during the composting process by up to 52%.

Armed with this finding, and prompted by queries from members about how to gain better nitrogen value from poultry litter, SANTFA set out to explore options for utilising biochar and chicken litter composts.

The project is being supported by a Community Landcare Grant and undertaken in conjunction with poultry producers and grain growers.

In the shed

The poultry industry has several challenges to overcome with bedding materials and volatile ammonia.

Ammonia is the main reason poultry sheds are ventilated; a costly exercise due largely to the need to re-heat the shed to replace the warmth lost in the ventilation process.

The trial is exploring the impact of adding biochar to litter at different stages of the system, including mixing char with the litter material before it is put into the poultry sheds.

Results so far have revealed no detrimental effect on poultry production from adding biochar to poultry bedding materials and some observations suggest bedding material containing biochar seem to pack down less than regular bedding straw. If this is confirmed it could prove to have significant benefits for poultry producers.

Greg Gaze, Production Manager at Southern Cross Farms, at Owen, is 'cautiously optimistic' based on what he has observed during the first round of biochar bedding trials in his poultry sheds.



SO THAT'S WHAT IT LOOKS LIKE! CROP WALK PARTICIPANTS CHECKING THE CHARACTERISTICS OF ONE OF THE LITTER/BIOCHAR COMBINATIONS USED IN THIS YEAR'S TRIAL PROGRAM.

"We saw no reduction in the birds' productivity, which was the first hurdle to overcome with our contract processor because the poultry input schedule is managed extremely tightly.

"We are very interested in what biochar can do as a bedding option in the future. If it helps us and can create value for grain growers too, all the better."

Much of the nitrogen in litter can be lost to the atmosphere during transport of the litter from the poultry shed to the paddock.

Measurements taken in an initial comparison of bedding material with and without biochar revealed no significant difference in nitrogen retention when char was added, which prompted a re-think.

"We went back to the drawing board and found some research out of the US in

which activated biochars were found to have significantly better nitrogen sorption than non-activated biochars," explained SANTFA Technical Officer Andrew Bird.

In this trial, with biochar made from wood shavings, wood shaving biochar activated with phosphoric acid (WS 500 PA) captured more nitrogen than non-activated char (WS 500).

"In hindsight, it made some sense. Ammonia is an alkali and most biochars are alkali, so like two magnets with the same polarity, there was little likelihood of attraction."

Ammonia, NH_3 , is volatile and mildly alkali. With the addition of acid, ammonia is readily converted to ammonium, NH_4^+ , which is vastly more stable and is a common ingredient in synthetic fertilisers such as DAP.



The prospect of acidification opened up new possibilities, with the potential to use phosphoric acid in the process adding another potential positive, given the litter compost was to be used on a limestone soil.

As with the untreated biochar used in the initial phase of the project, Greg Gaze reported the acidified biochar had no observable detrimental effect on poultry production. "When you first hear about an acidified biochar it's easy to worry about the birds' feet. However, the amount of acid applied is calculated to neutralise the alkalinity inherent to the biochar and the final product is only very mildly acidic."

Grant Pontifex, a Paskeville grain grower, has a turn-key straw supply agreement with a poultry farm to provide it with straw for bedding then remove the litter, which he spreads on his paddocks, at the end of the production run.

"We have had good success with applying poultry litter to our paddocks but the lack of available nitrogen after composting is a limitation we are keen to address," he said.

"We have just done a run of sheds that had acidified biochar applied and we'll be tracking the nitrogen concentration relative to un-treated litter through the composting phase and the crop response in the paddock."

Robert Sherra, who runs a mixed poultry and cropping property near Mannum, has several bedding challenges to overcome in the poultry side of the business and has been closely tracking the biochar cropping trial results.

"It's just one step at a time, but we are about to introduce two different acidified biochars into the bedding matrix with the aim of capturing more nitrogen that we can return to our cropping paddocks."

THE EFFECT OF DAP & 'POULTRY LITTER & BIOCHAR COMPOST' ON WHEAT YIELD, PASKERVILLE 2013

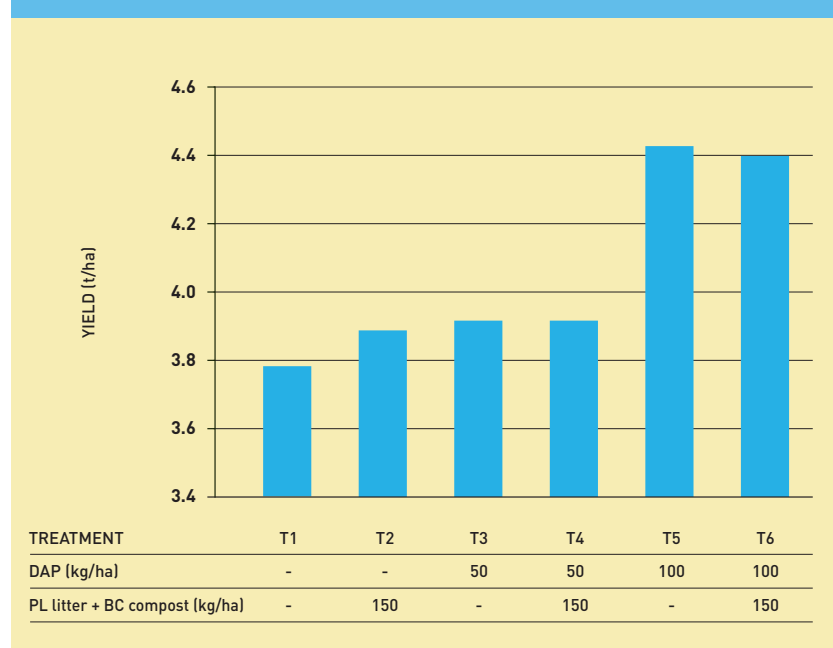


FIGURE 1. THE YIELD DATA FROM PASKERVILLE WAS REPRESENTATIVE OF ALL THREE 2013 TRIAL SITES THAT TESTED POULTRY LITTER AND BIOCHAR COMPOSTS AND THERE WERE NO STATISTICALLY SIGNIFICANT OUTCOMES TO REPORT FROM ANY OF THE THREE TRIAL SITES.

In the paddock

Results from other trials show that banding low rates of biochar made from poultry litter along the crop row can improve fertiliser efficiency. The impact of adding 'biochar and poultry litter composts' is not so clear.

In trials at Paskeville, Hart and Palmer last season, applying 150 kg/ha of poultry litter plus biochar had no statistically

significant impact on wheat yield.

Crops in areas treated with the litter/biochar mixture looked healthier than crops where no litter was applied but these field observations did not convert to a significant yield advantage.

However, as can be the case with organic inputs, more time may be needed for an effect to become evident.

"In field trials looking at the application of plain poultry litter composts over the past decade, the substantial benefits have generally become evident only when measured over a number of years," Andrew Bird points out.

"Many short-term experimental trials have been superseded by farmer experiences that have shown poultry litter to be quite valuable."

Acknowledgements:

- Landcare Community Grants, Department of Agriculture
- SANTFA board, staff and members
- Greg Gaze, Southern Cross Farms
- Grant Pontifex, Pontifex Farming
- Robert Sherra, Southern Poultry
- Clean Carbon Pty Ltd, biochar supply

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