Chicken Manure Trial - Glenaroua

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Location / address:	Chapmans Road, Glenaroua Victoria
Organisation:	Mackinnon Project University of Melbourne
Contact person:	Lisa Warn (project coordinator)
Fund source:	National Landcare Program and Rural Industries Research and Development Corporation
Years of trial:	2009 - 2013
Objectives of the demonstration	1. Evaluate and demonstrate the use of poultry litter as an alternative source of nutrients (phosphorus in particular) for pastures. 2. Promote and support adoption of the use of alternative fertilisers and practices that are cost effective and can improve soil organic carbon. 3. Evaluate if the use of poultry litter, broadcast on the soil surface, can increase the rates at which total soil organic carbon and more stable forms of carbon (humus) are built up, in comparison to use of inorganic fertilisers.
Basis of trial	Some livestock producers have been using poultry litter as an alternative fertiliser for pastures but there is little objective information about appropriate rates to use and responses. Much of the research has been conducted overseas (eg. Rothamsted long-term experiment) and Australian research, looking at changes in soil carbon, has focused on cropping or incorporating poultry litter, hence there was a need to look at responses to top-dressed poultry litter on pastures. • Poultry litter can be an economic alternative to inorganic fertiliser where several macro nutrients are required but this is very dependent on what price ($/m3) it can be delivered to the farm. Prices vary from district to district. • Top-dressing poultry litter as an alternative fertilise for pastures. • If only one nutrient is required, such as phosphorus or nitrogen, it is usually cheaper to supply this with a product like superphosphate or urea, but is wholly dependent on the cost of litter ($/m3 + delivery) relative to the inorganic fertiliser at the time. • When equivalent rates of macro nutrients are applied using either litter or inorganic fertilisers, similar pasture responses can be obtained. Although nitrogen losses can occur from poultry litter if rainfall doesn't occur soon after spreading. • Soil organic carbon can be increased with large inputs of poultry litter.
What did you do /soil treatments	Treatments • Control (Nil fertiliser) • Maintenance rate inorganic phosphorus fertiliser (100kg/ha superphosphate) • Maintenance rate inorganic phosphorus fertiliser + balanced nitrogen, potassium, sulphur • Capital rate inorganic phosphorus fertiliser (200kg/ha superphosphate) • Capital rate inorganic phosphorus fertilider + balanced nitrogen, potassium, sulphur • Maintenance rate poultry litter (fresh) (rate varies with batch but aim to match nitrogen, potassium, sulphur and phosphorus in one treatement) • Capital rate poultry litter (fresh) • High carbon rate poultry litter (fresh) 5t/ha • Humic acid product Replicated (4 times), randomised block design. Refer to the plot plan attached to this report.
Measurements When/method	Measurements a. Soil tests (0-10cm): nutrients (nitrogen, potassium, sulphur and phosphorus), trace elements/heavy metals, pH, salt, total organic carbon, cations (site establishment, and then spring each year). FarmRight Technical Services, Kyabram. b. Soil biological activity: total microbial biomass and FDA enzyme test (winter and spring in year 3). Department of Primary Industries, Wollongbar NSW laboratory.

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c. Analysis of carbon fractions in soil (0-30 cm) and soil bulk density (prior to treatments and in spring year 3). Department of Primary Industries, Macleod Laboratory Victoria. (Laboratories used are ASPAC/NATA accredited).
d. Litter nutrient content and microbial analysis for fecal coliforms (prior to application).
e. Pasture production (kg DM/ha) and species composition (monthly).
f. Pasture feed quality (winter and late spring).
g. Leaf tissue analysis: macro & trace elements (site establishment and each spring).

Results

- Overview of the country can be described as having sedimentary hill country with clay loam soil. It is used as a dryland pasture with phalaris and sub clover as the main ground cover. The average annual rainfall to the region is 600mm.
- The trial site was located on an east facing, lower slope.
- Grazed by Merino sheep and Angus cattle mainly set stocked but with occasional rests.
- Regular maintenance fertiliser (eg. superphosphate) the site had good soil fertility levels at start of experiment.
- A section of the paddock was fenced out and harvested periodically (simulated rotational grazing) followed by crash grazing with sheep. Compared nil fertiliser with maintenance fertiliser with capital inputs of fertiliser – compared inorganic fertilisers, poultry litter and humic acid.

There was a significant increase in Cation Exchange Capacity (sum of cations) of the soil (from 6.54 to 8.22 meq/100g) where 20t/ha of poultry litter was applied (5t/ha over 4 years) compared with the control (nil fertiliser) and maintenance inorganic fertiliser treatments. This was due to the increase in calcium rather than the other cations (magnesium, sodium, potassium and aluminum). This preliminary Cation Exchange Capacity data is very promising, particularly for light soils which are at higher risk of nutrient leaching, and could mean cost savings in fertiliser inputs.
Top-soil organic carbon content increased from around 3.30 to 3.75 with the addition of 20t/ha poultry litter compared with the Control and Maintenance fertiliser treatments.
Soil biological activity under different treatments was assessed in July 2012. Enzyme activity (FDA test) and total soil biological carbon (mg C/kg soil) were measured. There were no significant differences between treatments.
The pasture results highlight that poultry litter can be used as an alternative to inorganic fertiliser (containing similar rates of nitrogen, potassium, phosphorus, sulphur) to maintain or increase pasture production. So far, the poultry litter has not performed any better than the inorganic fertiliser.
The botanical composition (measured on a kg DM/ha basis) of plots changed over time. Compared with the Control, there was more clover in the poultry litter plots and more sown perennial grass in plots where nitrogen (urea) was applied. There was more native grass present in the Control plots. This is also important from a livestock feed quality and intake point of view.
For further information see: Warn, L. (2014) Chicken litter: alternative fertiliser for pastures and ways to increase soil organic carbon. RIRDC Publication No. 14/067.

's request.

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