

Case study to monitor nutrient flows on free range chicken farm

Hallora 2017

Case Study: Monitoring nutrient flows from a free-range egg farm for sustainability

Name: Tania Murray

Farm location: Hallora, Gippsland

Business: Free-range chicken eggs

Overview

Tania Murray ran a successful free-range egg business on her farm in Hallora, Gippsland. In 2014 she embarked on a trial with Western Port Catchment Landcare Network (WPCLN) to monitor how much nutrients the chickens were producing, and to see if it was possible to spread the chicken manure on other areas of the farm to improve soil fertility and long-term sustainability. With the support and advice from Landcare and the Department of Environment and Primary Industries (DEPI) she began trialing the use of chicken manure to improve the soil fertility, as opposed to the use of purchased fertilisers.



Tania with some of her chooks

The trial ceased earlier than expected but nonetheless produced positive results. The area of land with chicken manure applied showed higher levels of phosphorus, potassium, sulphur, pH and conductivity when compared to the benchmark soil results taken a year earlier. In the future it would be useful to replicate the trial over a long time-period to substantiate the initial findings.

Background

Tania Murray worked as a police officer in Melbourne for 19 years. In 2003, whilst working in the City, Tania came across an advert in the Trading Post for a 50-acre farm for sale in a place called 'Hallora'. Tania still remembers the day she saw the advert and the spark she felt as she considered life at a slower pace.

Throwing caution to the wind Tania purchased the farm. In 2004 she started her farming enterprise with 5 free-range chickens and in 2007 she expanded to start the 'Hens of Hallora' business. Tania admits 'we were *lifestylers*, we never expected to make money from it'. At the peak of her business Tania had nearly 500 chickens producing enough eggs for two weekly Farmers' markets.

By 2011 Tania had left the police force and was working on her farm full-time. The job had been taking its toll on her mental health and after 19 years it was time to move away from the City and reconnect with the land. In the first few months of working full-time at the farm Tania spent 11-hour days working with the chickens, sometimes going for up to 2 weeks without seeing people. She admits '*that was my therapy*'. Gradually the business grew and Tania spent more time attending markets. She admits that her free-range egg business and the warm welcome she received at the Farmer's Markets helped to regain her faith in people and relationships.

Over time Tania started to find a new confidence and after 2-3 years Tania was feeling more grounded and ready to re-evaluate her priorities in life. At this point she realised she couldn't sustain the 60-hour weeks and closed the free-range egg business. Knowing what she knows now Tania says the business could have been run more efficiently and productively and has learned valuable lessons from her experience.

The motivation for the trial

Having completed a degree in applied science (majoring in environmental studies), it's no surprise that Tania had an interest in taking her farming to the next level. Not content to use traditional methods of fertilising soil, Tanya wanted to see if free range chickens could add enough nutrients to the soil to be sustainable, with the ultimate aim of eliminating the need to buy-in nutrients for the soil.

The Trial

Tania wanted to investigate whether her free-range chickens produced enough manure to maintain the fertility of the soil without having to introduce purchased fertilisers.

The test area

The trial started in July 2014 using 3.2 acres of Tania's farmland. Before the trial commenced soil samples were taken to establish a benchmark to compare the results and to understand the nutrients needed to maintain healthy soil.

The designated area was sectioned into two paddocks:

- The 'control' area (1.51 acres), where no fertiliser was applied.
- The 'treatment' area (1.68 acres), which had chicken manure applied on a monthly basis.

Note: During the trial approximately 60 sheep continued to graze across the 2 areas (3.2 acres), which may have affected the nutrient distribution in the soil. Ideally the areas would have been grazed separately. The treatment area was not grazed for 3 weeks after manure application to avoid the risk of disease. There were no chickens grazing in either of the areas during the time the fertiliser was applied.

Table 1: Poultry litter nutrient content (adapted from Griffiths 2011)

Source of litter	Sample from Tania's cages (sampled July 2014)	Broiler litter Tunnel	Broiler litter conventional	Turkey Litter	Layer manure
Number of samples	1	16	6	8	8
Dry matter	26.2	78	72	68	59
EC	7.9	9.7	7.2	9.5	7.5
pH (H ₂ O)	7.0	7.6	8.4	8.0	7.8
Total Nitrogen %	3.03	3.9	3.3	3.8	5.8
Total Carbon %	32.8	41	42	39	33
Total Phosphorus %	2.10	1.05	1.33	1.7	2.2
Potassium %	1.89	1.47	1.33	1.9	1.68
Magnesium %	0.52	0.43	0.44	0.46	0.49
Calcium %	5.32	1.7	1.9	2.7	9.2
Sodium %	0.31	0.35	4.0	0.33	0.36
Sulphur %	0.68	0.49	0.43	0.49	0.45
Weight per m ³ (kg)		Average 550		Range 500-600	

The nutrient budget

A nutrient budget was completed in July 2014, which recommended maintenance applications of nutrients to hold the fertility of the paddocks at their current levels. Table 1 (below) shows the recommended maintenance requirement versus the actual nutrient content of the chicken manure that was applied to the 'treatment' area. The chicken manure applications were approximately three times more than required to maintain the current fertility of the soil. The high application rate was due to limitations with the manure spreader used.

Table 2: Nutrient content of the chicken manure application rates compared to the recommended nutrient budget maintenance requirement

Nutrient	Nutrient content of the manure (kg/1000kg DM)	Application rate of chicken manure to treatment (kg/ha) based on 2.18 tDM/0.61ha ~3.57 tDM/ha	Recommended nutrient application to maintain fertility at current level for the Chicken Manure Treatment (and all other treatments)
Nitrogen	30 kg/tDM	107 kg/ha	
Phosphorus	21 kg/tDM	75 kg/ha	27.5kg/ha
Potassium	18.9 kg/tDM	68 kg/ha	15.6kg/ha
Sulphur	6.8 kg/tDM	24 kg/ha	12.6kg/ha

How the manure was applied

The majority of the chicken's manure was naturally absorbed back into the soil where they grazed. However, they also produced additional manure that collected under their roosts. Tania collected the 'roost

manure' to fertilise the 1.68 acre treatment area. It was distributed using a manure spreader attached to the back of a quad bike. The manure was applied on a monthly basis with a total of 3.57 tonne/DM/ha of manure being spread over a 12-month period.



Tania spreading chicken manure

Financial impact

Overall the trial's associated costs were low. The chicken manure incurred no cost as it was a by-product of the free-range egg business. The main costs for the trial were Tania's time, fuel, and wear and tear on the machinery used (quad bike and spreader). Tania estimated that the time to collect and spread the manure was 22 hours. Assuming Tania's time is worth \$25 per hour this equals around \$550. In addition Tania estimates there was around 3 hours wear and tear on the quad bike.

If the equivalent quantities of nutrients were purchased from a fertiliser supplier Tania's chicken manure would equate to \$715¹ (at an application rate of 183kg/hectare). This is a considerable financial saving over the course of a year with the added benefit of being a sustainable source of fertiliser.

¹ Based on quote from Gippsland Bulk Spreaders, June 2016

The results

Table 3: Soil test results showing the differences in soil fertility levels between 2014 and 2015 for the Chicken Manure Treatment and the Slashing Treatments and associated controls.

Soil testing analysis	Chicken Manure Treatment			Slashing Treatment		
	2014 Benchmark	2015 Chicken Manure	2015 Control	2014 Benchmark	2015 Slashing	2015 Control
Phosphorus mg/kg (Olsen)	19	37	29	22	37	22
Potassium mg/kg (Colwell)	287	334	275	323	397	295
Sulphur mg/kg	7.0	16.8	14.7	8.2	9.9	15.9
pH (CaCl ₂)	4.7	5.09	4.71	4.58	4.81	4.89
Conductivity (dS/m)	0.079	0.123	0.106	0.07	0.104	0.107
Organic Matter (%)	10.3	9.8	9.3	8.5	8.2	10.9
Calcium (meq/100g)	11.87	12.32	9.13	9.84	8.36	13.73
Magnesium (meq/100g)	5.25	5.25	3.61	4.73	3.7	6.73
Potassium (meq/100g)	0.73	0.86	0.7	0.62	1.01	0.75
Sodium (meq/100g)	0.44	0.47	0.31	0.37	0.23	0.46
Aluminium (meq/100g)	0.09	0.07	0.23	0.12	0.16	0.07
Hydrogen (meq/100g)	0.27	0.21	0.25	0.27	0.18	0.26
Cation Exchange capacity (meq/100g)	18.66	19.18	14.22	15.95	13.64	22.01
Zinc (mg/kg)	5.4	8.8	5.4	3.6	11.3	4.9
Manganese (mg/kg)	67	31	21	38	31	36
Iron (mg/kg)	405	379	472	396	447	347
Copper (mg/kg)	1.4	1.3	0.8	0.8	1.1	1.2
Boron (mg/kg)	0.74	0.77	0.48	0.81	0.7	0.89
Silicon (mg/kg)	51	53	41	49	51	68
Total Carbon (%)	5.87	5.58	5.29	5.17	4.69	6.2
Total Nitrogen (%)	0.49	0.46	0.44	0.44	0.37	0.48

The trial only lasted one year (2014-2015) due to Tania's decision to close down the free-range egg business. The first year results, however, were positive and showed that free-range chickens can improve soil fertility. The results showed:

- the chickens produced enough manure to fertilise their own area through grazing, with surplus from the roosts able to fertilise the same size area again
- the area where chicken manure was applied had increased phosphorous, potassium, sulphur, pH and conductivity levels, whilst also increasing the cation-exchange capacity of the soil. The chicken

manure supplied more than the recommended level of nutrients required to maintain soil quality levels.

What could be better next time?

Ideally the trial would be conducted for a longer time period to substantiate the findings of Tania's one-year trial. The initial results show that this method of fertilisation is effective and that it is possible to maintain and increase soil fertility without the need for additional nutrients being applied to the soil where free range chickens are grazing. It would be interesting to see the wider impact of rotating chickens around paddocks, and whether this practice could completely cease the need for external fertilisers in a larger farming area.

Tania says that if the business had continued she would have continued to use this method of farming. The idea of rotating cattle would have been next on her agenda, potentially grazing dairy cattle followed by chickens to evenly disperse the manure.

Tania would have liked to trial mobile sheds for the chickens as opposed to fixed shedding to make it easier to distribute the manure throughout the land. This was difficult in the chicken's current location as they were grazed on elevated land.

Tania believes using chicken manure keeps the land healthy, free from weeds, and free from the need to import synthetic fertilisers and chemicals. She explains *'certain farming practices seem to bring on certain problems, and those problems are dealt with in a certain way, and then they create more problems. If you strip it down and go back to basics the land finds an equilibrium and looks after itself'*.

What next?

Although the free-range egg business has finished Tania is still very much in the farming world. She now works at a local dairy farm and is eagerly learning her new trade. The main difference, she says, is that *'instead of 2 inches of mud, it's a foot of mud!'* Tania has worked hard to manage her farmland and make it sustainable for the future. She has planted thousands of trees across her 50 acres and fenced off all the gullies and steep hills that are difficult to access. It's been a labour of love that has cemented Tania's connection to the property forever.

Conclusion

For Tania, her farming and the trial were more than just discovering a new sustainable farming practice. Whilst sustainable farming remains a passion, Tania feels that re-connecting with the land and establishing her farm ultimately saved her. Tania believes that *'a little bit of hard work, a bit of knowledge, looking after the soil, and looking after the environment, and it will pay you back'*.

She is grateful to Landcare for their support and says the trial would not have been possible without their help and knowledge. Tania acknowledges that it's not easy to try new farming techniques due to a lack of knowledge, resources and finance but highly recommends to anyone to give it a go.

Tania says that one day she may have chickens again but it's unlikely that she'll re-commence the egg business. Having taken part in the trial Tania is keen to share the information she's learned with others, *'I've got lots of information, I've done the groundwork and I want to pass that onto other people'*. Tania would love to start a business consulting to people who are interested in farming chickens or wanting to have chickens in their back yard.

Key learnings from trial

- The area of land grazed by the chickens showed higher levels of phosphorus, potassium, sulphur, pH and conductivity when compared to the benchmark soil results.
- The chicken manure supplied more than the recommended level of nutrients required to maintain soil quality levels and pasture productivity.
- The natural chicken manure deposition eliminated the requirement to purchase fertiliser.

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