



final report

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PRODUCER **I**NITIATED **R**ESearch **D**EVELOPMENT

Red Gum Plains Soil Health Group

Final Report for MLA PIRD project 2006/V03

March 2010

Soil Productivity with Naturally Occurring Additives

Project Description

To increase beef/lamb production by 10% (or 10 kg live weight per hectare) on the Red Gum Plains of Gippsland by improving the biological activity of soils in order to achieve healthier more productive soils, pastures and animals.

Project Objective

1. To have 12 members of the group knowledgeable about the benefits of enhanced soil productivity through using different organic additives.
2. To demonstrate whether it is possible to import, on a commercial scale, organic additives that may function in place of the missing micro-organisms and enzymes.
3. To increase beef/lamb production by 10% or 10 kg live weight per ha.
4. To restore enzymes in the soil nitrogen cycle (and probably other soil cycles as well) and confirm their presence via DNA testing.
5. To demonstrate whether there is a relationship between improvement of soil health and increased productivity by 10% (weight gain of livestock grazing the pastures enriched with organic additives tested through the proposed demonstration.
6. To trial these additives to determine if the importations enhance and sustain long-term soil productivity.

Hypotheses: Organic additives such as poultry manure, brown coal, molasses and compost tea, may be cost effective enhancers of soil productivity, pasture growth and weight gain of livestock. Restoration of missing DNA (i.e., missing soil micro-organisms and their enzymes) could be accomplished with applications of poultry manure and compost tea, but perhaps not with brown coal and sugar, substances lacking living soil micro-organisms. It is possible that

brown coal will stimulate existing micro-organisms. It is also possible that the “missing” micro-organisms are present on the demonstration farms but in such low numbers that they were not sampled earlier. If so, is it possible that the additives might change soil conditions to benefit these micro-organisms and permit their increase?

From these trials we hoped to learn more about how to “farm” beneficial micro-organisms so that they can foster and sustain higher productivity as well as engaging the broader community in answering the questions we were asking and pursuing soil health in general.

Methodology

Four farms in the Forge Creek, Bengworden, Llowalong and Briagolong areas hosted the demonstrations. Molasses, compost tea, poultry manure and brown coal respectively were applied to seven hectare paddocks (recommended by Soil Foodweb Institute based on soil samples collected in April 2007) and comparisons were made with a similar sized control treated the same as the rest of the farm. Grazing weight gains and pasture growth measurements were to be recorded. A series of different soil tests were carried out over the three year period along with various other activities. These can be divided into two groups; management and communication. Management activities included trial planning, actions, meetings, soil testing decisions and reporting. Communication activities included field days, farm walks, seminars, workshops and media releases prior to and following events. All these activities contributed to the methodology and are outlined in the Timeline document. (See Appendix One.)

Data Analysis

In November 2009 the group sought to have the soil tests analysed as recommended by Associate Professor Pauline Mele but there was insufficient data collected to carry out a statistical analysis or accurately assess differences between the controls and additive paddocks. This is supported by Dr Steven Wakelin’s comments following. The group wishes to acknowledge Associate Professor Pauline Mele’s generous contribution to the group to launch the project, by attending the final farm walk and sharing new knowledge.

Soil test differences

CSIRO *“Report to the Red Gum Plains Soil Health Group”* Dr Steven Wakelin
June 2009 **Executive Summary**

“DNA based tools were used to characterise the response of soil microbial

communities in farming systems receiving addition of organic treatments such as coal dust, molasses, compost tea and poultry manure.

Samples were collected over a three year time period (2007-2009) and delivered to CSIRO Land and water for analysis. CSIRO Land and Water undertook analysis of bacterial and fungal community structure and diversity, and also quantified the *nifH* gene which is functionally linked to Nitrogen fixation by soil bacteria.

Bacterial and fungal communities in the soils were significantly different between farms – the largest factor determining the species of microorganisms present was the farm the soil originated from. This is consistent with much of the literature.

For each farm, significant shifts in the types of bacterial and fungal species occurred over time. This temporal effect was also mirrored in the changes of key diversity indices (richness and evenness) for the microbial communities. The significant ‘time’ effect may have been due to adverse climatic conditions during the 2007-2008 season.

Within each farm, changes in soil microbial species composition and diversity of the communities were evident in some treatments. Caution should be exercised in interpreting these changes as it was not possible to undertake tests for significance at the treatment level.”

Other soil tests used in the trial (SWEP and Soil Food Web) were unable to be compared. The reasons for this include the timing of sampling, the sampling methods used and the technical basis of the tests being different. Comments relating to these issues can be found in the Evaluation Workshop notes - Appendix Two.

Weight gain differences

Weather conditions during the three year trial have been a challenge. Rainfall has been well below average. Therefore it has been difficult to find measurable weight gain or pasture growth differences at each of the demonstration sites. Weight gains on each farm have either favoured the additive site or the control at different times and were considered by each farmer participating in the trial to be insignificant. One of the aims of the project was for a 10% increase in production but this has not been the case.

Group learning

On 3rd March, 2010 the group conducted an Evaluation Workshop facilitated by Greg Forster attended by 15 people. The group discovered the trial work to be challenging both in design and implementation. Following are the group's original objectives and some general responses regarding their achievement.

1. To have 12 members of the group knowledgeable about the benefits of enhanced soil productivity through using different organic additives.
 - a. The group did achieve the objective of educating 12 members about the benefits of enhanced soil productivity through using different organic additives. This is supported in the workshop by points highlighted with the following symbol (⊙). See Appendix Two.
 - b. Educational opportunities were achieved by participating in the trial, attending field days, seminars and workshops.
 - c. Generally speaking the group did not achieve the trial objectives e.g. live weight gain and production increases, but did believe the first objective was accomplished in having farmers more knowledgeable about soil productivity and using different additives.
2. To demonstrate whether it is possible to import, on a commercial scale, organic additives that may function in place of the missing micro-organisms and enzymes.
 - a. This objective was not achieved due to limitations in project planning and implementation. In particular the appropriate selection of monitoring tools to evaluate the impact of the additives. Economic data was also heavily skewed due to the size of the trials and the relatively small additive quantities required. These small quantities attracted a large price premium not reflecting commercial rates. This is supported in the workshop by points highlighted with the following symbol (□). See Appendix Two.
3. To increase beef/lamb production by 10% or 10 kg live weight per ha.
 - a. A 10% difference in total live weight gain from the measurements taken was found in the Brown Coal trial. However the difference was in favour in the control rather than the additive site. No discernable differences were achieved in the remaining trials. Possibly due to the various planning and implementation issues. This is supported in the workshop by points highlighted with the following symbol (◆). See Appendix Two.
4. To restore enzymes in the soil Nitrogen cycle (and probably other soil cycles as well) and confirm their presence via DNA testing.

- a. Original DNA soil test data from the trial did not indicate a total absence of enzymes involved with the soil Nitrogen cycle therefore did not provide a basis for restoration by amendments. (See Figure 11 CSIRO DNA report.)
 - b. A population increase of Nitrogen fixing genes was experienced during periods of the trial but these cannot be attributed to the treatments alone e.g. soil type and climatic conditions. (See CSIRO DNA report.)
 - c. This objective was not met due to planning limitations and the complexity of the trial being beyond the capacity of those involved. This is supported in the workshop by points highlighted with the following symbol (□). See Appendix Two.
5. To demonstrate whether there is a relationship between improvement of soil health and increased productivity by 10% (weight gain of livestock grazing the pastures enriched with organic additives tested through the proposed demonstration.
- a. There was no data found to demonstrate any improvement in soil health or an increase in productivity by 10% caused by the additives therefore this objective has not been met.
6. To trial these additives to determine if the importations enhance and sustain long-term soil productivity.
- a. There is no data to determine if the importations have enhanced soil productivity. However there is some anecdotal evidence to suggest positive change.
 - i. Photo 1. October 2009 farm walk on the Compost Tea site.
 - ii. Brown Coal may produce improvements in soil productivity in the long term as indicated by mid 2008 and early 2009 grazing trial results. (See Appendix 3 page 27.)

Members have indicated no on-farm practice change as a result of the additives used however good grazing management and timing have been identified as critical tools for improving production and animal health. This view is supported in the workshop by points highlighted with the following symbol (❖).

Trial measurements have indicated the following;

- o Small quantities of additives are expensive and do not reflect commercial costs (See Timelines, MLA reports and workshop presentation in Appendix One.)
- o Brown coal may provide benefits over the long term beyond this trial period

- Trial results to date suggest no inputs (of those tested) maybe more beneficial to the members bottom line. This view is supported in the workshop by points highlighted with the following symbol (○).

No clear environmental benefits have been identified as a result of the project.

Field Days/Farm Walks/Speakers

A range of soil health specialists and guest speakers attended field days, farm walks and meetings during the three year project including Dr Pauline Mele, Gerard Grasser, Kevin Hughes, Dr Cathie Harvey and Sonia Lee. Group participants believe lessons learned from the range of speakers have been very beneficial.

A large number of farmers as well as others involved in extension work including DPI and private organisations participated in these events. In total more than 150 people attended the farm walks, seminars and field days, some attending up to three of these events.

People attending the evaluation workshop believed it to be a most useful day and one of the best wrap ups for any project they had witnessed. (See Appendix One for Timelines and media releases.) Comments at the workshop relating to the field days include;

- The value of incremental learning (at field days was mentioned many times)
- Walk, touch, smell and feel at farm walks
- Repetitive messages re management and timing of farm activities make people think about their management decisions
- Peoples passion and enthusiasm rubs off
- Challenging conventional thinking
- Farm walks and speakers provide learning opportunities
- Exposes people to a different way of thinking
- Valuable to have respected conventional mainstream farmers looking at something different involved in the trial

Overall the group was not satisfied with the results of the project. This view is supported by points listed under Project Satisfaction in Appendix One.)

The group has identified numerous ways the project could have been done better. Most improvements relate to the planning and technical aspects of the project including:

- improved focus
- better selection of tools
- set achievable objectives
- clarify objectives
- support for farmers
 - to interpret technical information
 - to provide guidance
- match tools with monitoring objectives

At this stage the group is not driven to run another project, particularly given the difficulties encountered in this trial including difficult seasonal conditions. A trial in the future may be considered, with the identified improvements being implemented in any future work.

Although the group has found the trials to be challenging, the benefits have outweighed the negatives. Therefore the group would recommend others being involved in similar projects.

The group wishes to acknowledge the time and effort Greg Forster has given to the final stages of this project far exceeding his initial brief. It is believed his involvement from the beginning of the project would have resulted in much better outcomes.

The group also thanks MLA for the funding opportunity to carry out this demonstration and wishes to recognize and thank Gerald Martin for his patience and understanding of the challenges of farming.

Finally the authors would like to acknowledge the trial hosts Trevor Caithness, Colin Stothers, Rick Robertson and Peter Young. Without their contributions the district would not have experienced the associated benefits of the trials.