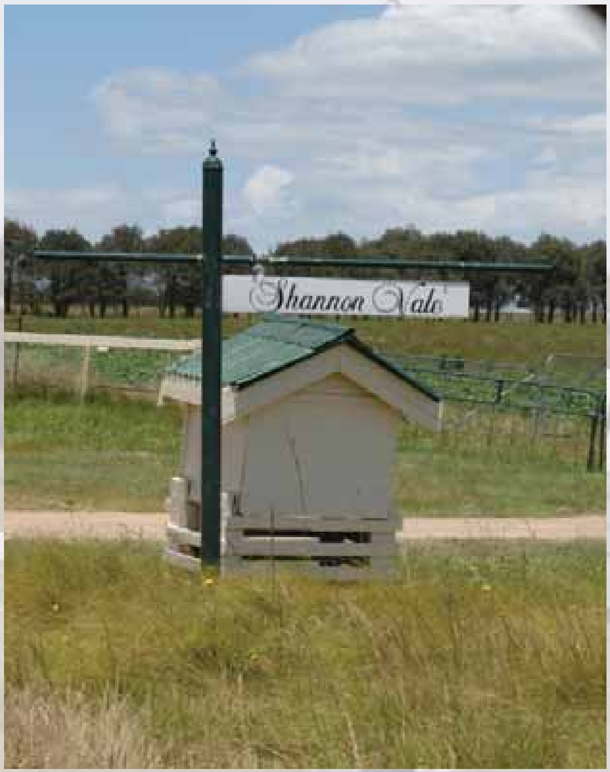
Shannonvale Station

"Exploring new horizons"

Shannonvale Station is a 1200 hectare commercial and stud beef property located 15km east of Glen Innes. The average annual rainfall is 900mm. But the average since 2000 has been 793mm, with a range since 2000 of 525mm in 2002 to 1028mm (almost 300mm fell in March) in 2001.



Soils

Grey loams to brown sandy loams derived from the transitional granite base, also some ironstone derived soils. The soils are characterised by low cation exchange capacity range in sampled paddocks 2.35 - 5.35 - Goal 5.5 to 7.0.

The pH has been steadily increasing that is, reducing in acidity. The range for our March 08 sample was 4.43 – 6.02 (1:5 water).

Total carbon is interesting, the soil tests from 2002 – 2006 showed the total carbon content averaging 1.0% range 0.74% to 1.40%. In 2008 that total carbon content averaged 1.46% range 1.00% to 1.82%, Goal 2.5%. The compost treatment in Dowlings could well have attributed to an increase in total carbon of from 0.76% in 2006 to 1.6% in 2008. In Rusden the increase is from 0.74% in 2006 to 1.46% in 2008.

Phosphorus (P) was limiting in 2002 the P levels using the Colwell test averaged 31 in 2008 they averaged 34.5 range 24 – 61 with 45 our Goal.

Aluminium toxicity is an issue, it has to be addressed we've used lime to adjust this problem. As with any soil / plant system nitrogen is an issue, it is essential in driving the protein component of the animal intake at pasture. It's our intention to drive the 'Nitrogen' (N) cycle via both the legume / rhizobia plus the decaying second order microbes.

The natives and naturalised species include those typical of the North Eastern New England e.g. Microleana, Danthonia, Paspalum, Yorkshire fog, Fox tail, Red grass, Carpet grass, African lovegrass and the legumes e.g. medics, ball clover, lotus, vetch.

The improved species debate is most interesting. Since arriving on the New England we have tried the annuals e.g. a range of rye grasses, oats, millet. The major criticism of these species is that they have to be planted each year, we simply cannot justify the cost both monetary and physical degradation of soil structure, soil erosion etc. It doesn't make sense (to us) to be using annual species e.g. ryes that have been developed for rainfall of 1,000mm+ when the New England rainfall for this decade is in the range of 550 – 1,000mm.

We have tried the Brassicas, again they are an annual event and need a 'fine seedbed". Plantain is an interesting species, true its an annual yet once established produces large volumes of seed, it will regenerate itself, it appears to thrive under the lower pH, lower Phosphorus soil levels.

We have grown the summer annual legumes e.g. soy beans and dolichos lablab. We had tremendous results form the lab lab due to its nitrogen fixing capabilities. The problem with these summer annual legumes is the associated weeds – castor oil etc. The chemicals needed to contain such pests most definitely reduce soil microbial activity.

The clover species tried include N.Z. White, Haifa White, New Siral, they all persist reasonably well, unfortunately we are noticing a reduction in their reseeding capabilities. We have tried Arrowleaf clover, in its first season it is extremely prolific and while it produced abundant flowers there has been little if any seed set. Its important the agronomic researchers investigate the Arrowleaf seed set problem as it's a legume that thrives in these lower pH, lower phosphorus, higher aluminium soils. Astrid and American red clovers work quite well during the summer and their seed set is prolific as with all the introduced / improved species their performance is rainfall dependent. The New England needs a greater diversity of persistent legumes.

The tall fescues (Demeter is still difficult to beat in this part of the world) and the Cocksfoots are our preferred perennial introduced grasses. Atom prairie grass while an annual provides great early spring feed, as prolific seed set will establish from broadcasting onto the ground surface, preferably into a leaf litter.

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Why Compost?

Composting is a very effective form of waste recovery and recycling of organic by-products. The composting process enables raw organic material to be converted into a stable, carbon, nutrient and humus complex. Humus is organic matter that has been converted by micro organisms through the humification process i.e. it has been consumed and excreted by the biology, therefore it is a biologically active, stable and nutrient bound substrate ideal for soil amelioration.

By composting organic waste products an otherwise wasted and troublesome by-product can become a valuable, nutrient bound biologically active compost that is able to be spread on farm which may contribute to future sustainability of our soils as well as to improve soil structure, nutrient availability, soil "health" and biological activity. By ensuring that the micro-biological component of the soil is appropriate i.e. adequate bacteria / fungi / protozoa / nematodes etc then nutrient cycling, soil structure, water infiltration should improve.

What is composting?

There is no universally accepted definition of composting. Australian Standard 4454 (2003) defines compost as "the process whereby organic materials are microbiologically transformed under aerobic conditions for a period not less than 6 weeks, which includes a pasteurization phase".

Another definition by Haug (1993) is "the biological decomposition and stabilisation of organic substrates, under conditions that allow development of thermophilic temperatures as a result of biologically produced heat, to produce a final product that is stable, free of pathogens and plant seeds, and can be beneficially applied to land." These definitions are appropriate as they are very much in line with the methodology used in windrow composting and the desired outcome of the composting process.

Compost is the result of process, not just product, when composted correctly humic substances begin to form. Humification is the process where humus is formed through the breakdown and digestion of organic material by micro organisms. A more scientific explanation - "through humification, complex polymers are disintegrated into simpler segments; the micro organisms remanufacture or recombine those simple segments or units into altogether different sequences, thus forming a complete series of new and different complex polymers and eventually forming humic molecules" (Jackson quoted in ACS 2001). This material is known for its capacity to hold four times its mass of water, can have a Cation Exchange Capacity (CEC) of 200-450 (meq / 100g) (Blair, 2004), and is recalcitrant or complex enough to provide energy that is sustainable over long periods of time.

Attention to process control (monitoring & managing) is critical to produce a quality, humified product that has eliminated pathogens, has a diverse range of organisms, has stabilised carbon & nutrients within biomass, all in a fully aerobic environment!

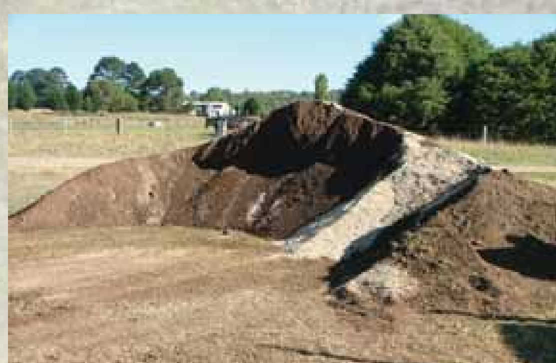
N.B. compost is not feedlot, poultry shed or pig shed manure these ingredients can and are used to construct compost. There are three fundamental components of soil:

1. *The physical / structural component*
2. *The chemical*
3. *The biological.*

Over the past 50-60 years in the quest to improve crop and to a lesser extent pasture yields, investment in the soil chemistry component has been significant and it has been at the expense of the physical and biological. More recently practices such as minimum and zero tilling 'tramlining' etc. have been developed to address the water retention issue (a physical / structural attribute). Interestingly not only did the 'chemical age' focus on synthetic soil nutrient addition / replacement, it also focused on using chemicals to control weeds and insect predators.

The fact that these chemicals 'terminated' life (plant or insect) meant that they were also having a similar effect on the soil microbiology. The resultant reduction in soil microbial activity has meant a reduction in the conversion of 'leaf litter' to soil organic matter / soil carbon. Reduced organic matter contents has meant lesser structural attributes resulting in lesser water holding capacity, lesser cation exchange capacity etc. Quotations in the literature detail an increase of one percent (1%) soil carbon in the soil profile as providing that soil with the ability of storing an additional 140,000 litres of water / ha.

Dowlings, one of the paddocks we have been composting since March 07 has had a measured carbon increase of 0.84% (0.76% - 1.6%). This paddock can therefore store an additional 115,000 litres of water / ha. While we haven't any accurate measurement data to illustrate improvements in dry matter production we do have sample bull weights illustrating that their first graze (3 weeks duration in October 08) averaged 1.5kg / day and their second graze (3 week duration December 08) averaged 1.2kg / day. The stocking density was 85 bulls per 35 ha.



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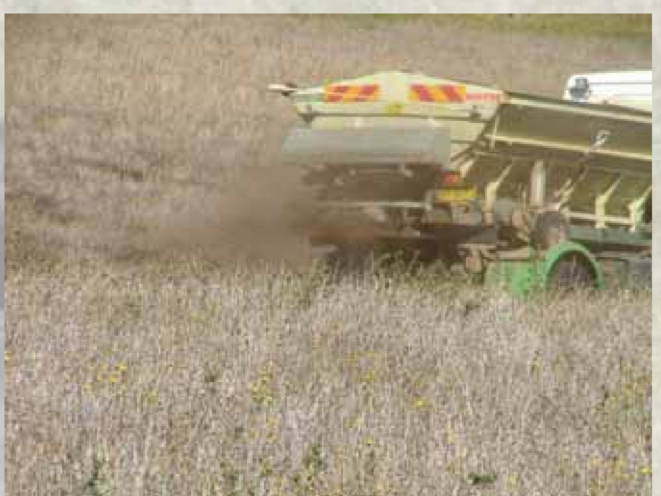
Compost Application

There are many unknowns re the use of compost. The most satisfying means of combating the unknowns is to work with people of similar ilk. In that respect we've been very fortunate to have teamed up with Bruce Picone, Tallawanta Feedlot (Bruce makes the compost at Tallawanta) and Bart Davidson / Chris Teague, Bio Nutrients (Bart and Chris provide Bruce with the technical advice re the construction of the compost and us with the agronomic advice re application rates, timing etc.). Our other partners include our immediate neighbours, Geoffrey and Pauline Smith plus Peter and Dawn Dowling - its great to have generations of 'local' knowledge as back-up.

Bio Nutrients has had experience with the compost and farming – grain and cotton etc. but very little with grazing, most the European experience is also with farming and / or incorporation of the compost into the soil. Under the grazing system we are 'top dressing' the compost at the rate of 300kg / ha, the rate being used at Tallawanta indicates that the 300kg / ha rate is achieving wheat and barley yields equivalent to 8 tonnes of raw wet manure / ha. In one of our paddocks we have trialled zero, 300kg and 600kg applications.



Shannon Vale does have some paddocks with sulphur deficiencies and because we are trying to make our legumes help drive the nitrogen levels we did incorporate 200kg of Gypsum with the 300kg of compost last October. October 2008 we topdressed 530ha; 105 ha @ 300kg compost plus 200kg Gypsum and 425 ha @ 300kg / ha.

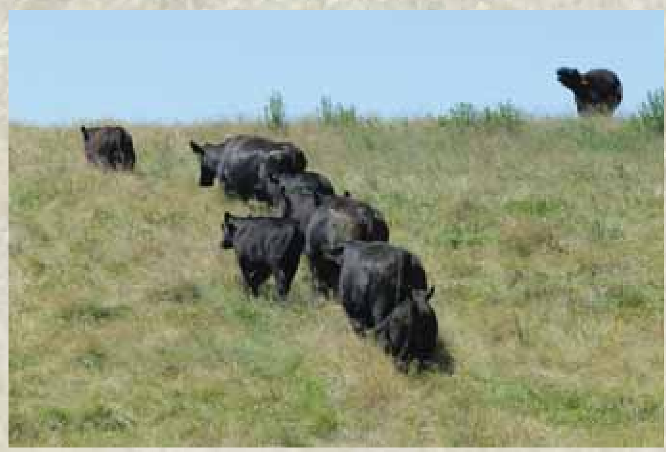
The spreading costs work out at $12 / tonne and the standard Pasture mix at $230 / tonne delivered. As a comparison it cost us $4 / ha less to apply the compost than it did to apply 125kg / ha Single Super. We will be applying 60 tonne in March 2009.

Management Practise Changes in the Past Three Years

Compost as our fertiliser replacement, is a part of the Holistic approach to the biological method. Significantly we haven't neglected the 'chemistry' as already illustrated we have attempted to rectify the Sulphur deficiencies by applying gypsum with the compost. One of the initial standard compost ingredients is Calcium phosphate and Peter Dowling has used compost with Potassium and Molybdenum added.

The other components of our biological method include:-

i. Reducing cultivation and traditional seed bed preparation we haven't cultivated on Shannon Vale for 18 months.
ii. Identify species that can regenerate from own seed set with no cultivation e.g. clovers, lotus, vetch, prairie grass and plantain.
iii. Broadcast these seeds onto paddock with compost, ensure sufficient protection – standing stubble and litter on the ground. Then roll with tyre roller.
iv. Reduce use of chemicals – "chemicals destroy the beneficial Saprophytic microbes".
v. Promote dung beetle activity. The molasses based supplements help cattle digest lowly digestible pasture stubbles thereby leaving softer dung (particularly in winter) which is much easier for the dung beetles to bury and so re-cycle valuable nutrients.
vi. Rotationally graze.
vii. Work with the 'undesirables' e.g. love grass and rats tail fescue, love grass is a great host plant, it provides invaluable protection, it provides ground cover, excess can be mulched down thereby providing an essential nutrient source for the beneficial 1st order microbes (fungi etc). This process of converting the love grass mulch to organic matter / soilcarbon improves both the physical and nutrient holding capabilities of the soil.



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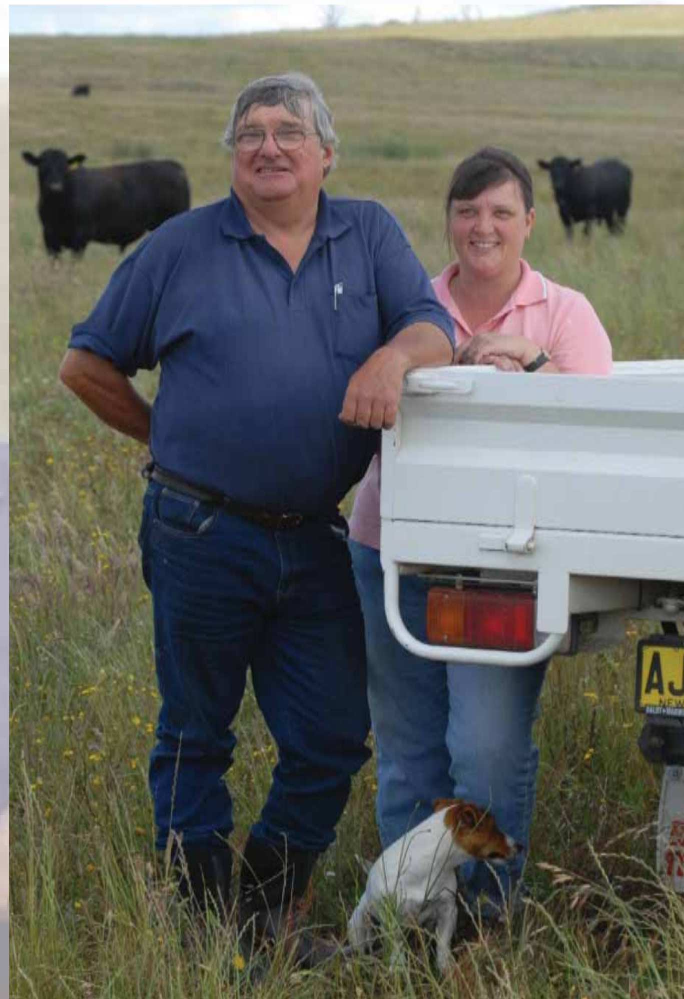
The Future

Unfortunately very few of the answers to the myriad of questions re the biological approach tomanaging grazing systems on the New England are known.

- Does top dressing with solid state compost actually work?
- What is the best time to apply the compost?
- How long can these compost incorporated microbes remain viable?
- What effect does the harsh New England winter have on these organisms?
- Once we build the carbon content up to 2.5% and above can we maintain that level by applying compost tea onto mulched down 'old stubbles'
- What is the best time to mulch?
- What techniques are available to test how much of the litter is being broken down / incorporated?
- Do we have to incorporate '2nd order' microbes to attack the saprophytes and so produce surplus N2 ?
- How can we maintain P levels and for that matter the micro-nutrients e.g. boron, molybdenum etc, cost effectively?
- How can we quickly measure for the presence of the 'useful' soil microbes?
- Methane is a 'nasty' by product of ruminant grazing animals. Can the biological approach 'cycle and store' sufficient carbon in the soil to offset the methane?
- Do well managed biologically friendly grazing systems with a goal to cycling and storing carbon in the soil to derive structural (water holding nutrient holding C.E.C) benefits, store more carbon than young trees?



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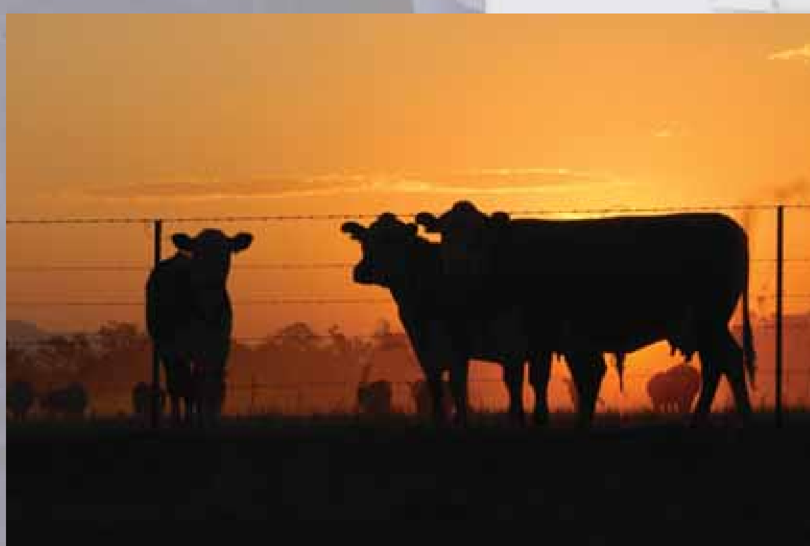

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