



SOIL HEALTH case study

Improving soil health using compost manure

Darling Downs cotton grower, John Cameron, has been using composted feedlot manure for many years and believes this organic soil amendment plays an important role in maintaining the long term sustainability and profitability of his farming operation.

According to John, the strategy is about maintaining good soil health and building resilience into the production system. Combined with minimum tillage, stubble retention and good soil management practices, John believes his soil now has the capacity to deliver in tough seasons as well as responding in good times.

John applies composted feedlot manure at a rate of four to five tonnes per hectare every five years. This works out to two cotton crop cycles per application, but can be pushed out to three crop cycles if necessary. The manure is applied to the soil surface in standing wheat stubble.

“I use compost because it is in a more stable form. I don’t have to work it in until I’m preparing to plant the next cotton crop. Rain helps wash it into the soil profile and being a self mulching soil, a lot of the product falls down the cracks in the soil,” said John (pictured with agronomist Jamie Innes).

“We can also apply it at a time when we are not busy, making management easier. One limitation is the soil must be dry. Compaction with this heavy gear is a real concern and must be managed.”

The compost provides all of John’s crop phosphorous, potassium and micro-nutrient needs, particularly zinc and sulphur. Soil tests have shown an improvement in

Background:

“Kintyre”, Bongeen, QLD Darling Downs

- Cameron family farming operation.
- 1,500 hectares dryland crop area.
- Cracking black soils with approx 330mm water holding capacity.
- Crops: Principle focus is cotton, with the primary rotation consisting of cotton double cropped into wheat every two years. Sorghum is substituted for cotton, and barley or chickpeas planted instead of wheat if conditions are not favourable for a cotton/wheat program.
- Beef feedlot manure compost is applied ideally at every second cropping event, or as financial conditions allow.



both phosphorus (P) and potassium (K) level over time (see Figures 2 & 3) although soil organic matter levels have not changed significantly (see Figure 1).

John doesn't rely on nitrogen (N) from the compost. Nitrogen is still applied as urea. John fertilises for a five bale per hectare crop but believes his soil now has the resilience and buffering capacity to produce a 10 bale per hectare crop given the right conditions, without any further fertiliser applications. This was evident in the 2012-13 season when his raingrown crop average was over 10 bales per hectare.

"The crop didn't show any nutrient deficiencies and really performed," said John. "It takes time for the system to start to work. Once it is up and working for you there are real differences.

"The compost combined with crop rotation, stubble retention and minimum tillage have seen improvements in soil condition and the capacity of the soil to respond in both good and bad seasons."

What is Soil Organic Matter?

Soil organic matter includes everything that is of biological origin and by definition, rich in carbon. It is composed of dead and decomposing plant material, litter, humus, soil biota (fungi, bacteria, earthworms etc) and their waste material.

Soil organic matter plays an important role in the three key aspects of soil fertility:

1. Biological functions: organic matter supplies nutrients for plant growth and provides energy and nutrients for soil micro-organisms.
2. Physical functions: organic matter stabilises soil structure and promotes soil aggregation, improves soil water storage and infiltration.
3. Chemical function: organic matter increases soil cation exchange capacity, buffers soil pH, reduces effects of salinity and sodicity.

The soil biological system is extremely complex and only a fraction of soil organisms have been identified. One of the most important processes in soil is nutrient cycling, with organic matter typically providing the largest pool of soil nutrients. It's estimated that 80-90 per cent of the biological activity in soil is carried out by bacteria and fungi, with biological activity resulting in the release of nutrients (mineralisation) from organic matter in a form available for plant uptake.

Figure 1: Organic carbon. Organic carbon levels measured pre-planting from 1994 to 2012 indicate a steady decline in organic carbon over time even though organic amendments have been applied to the system.

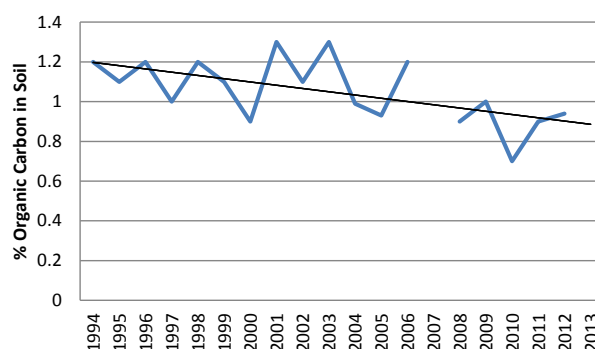


Figure 2: Phosphorus (P) Trend Line. Phosphorus Colwell P levels (mg of phosphorous per kg of soil) pre-planting from 1994 to 2012. Peaks in the graph correlate with amendment applications followed by a period of crop removal. The overall trend line indicates a steady build up of P in the soil profile.

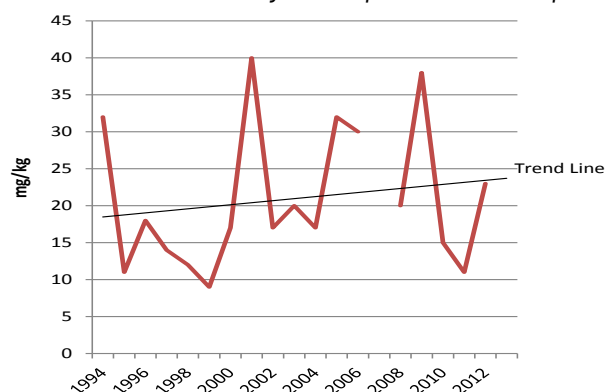


Figure 3: Potassium (K) Trend Line. Exchangeable K levels (cmol of potassium per kg of soil) pre-planting from 1994 to 2012. Peaks in the graph correlate with amendment applications followed by a period of crop removal. The trend line indicates a steady increase in K levels over time.

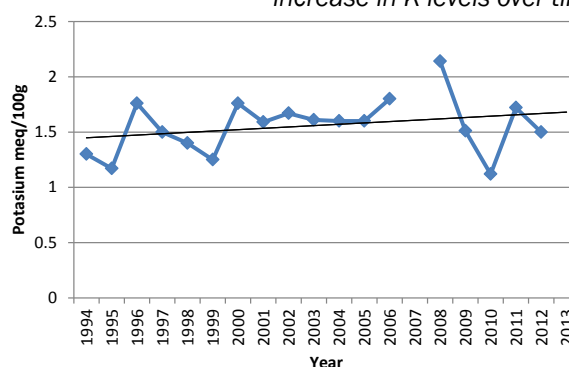
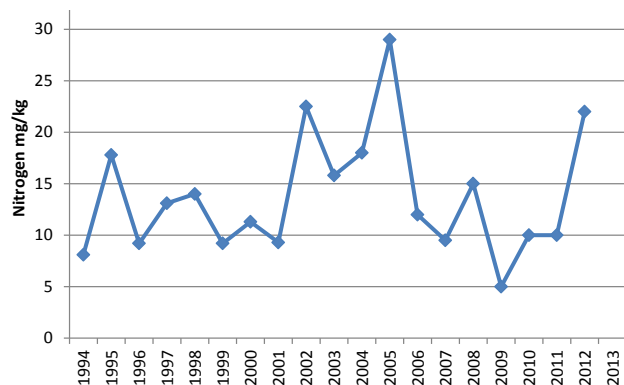


Figure 4: Nitrogen (N). Available N levels (mg/kg) pre-planting from 1994 to 2012. The trend line indicates an increase in N over time.

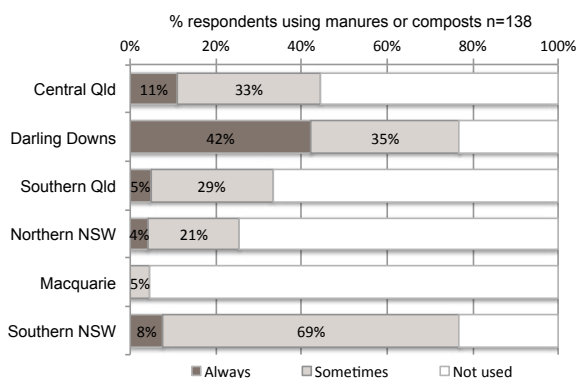


Organic amendments and cotton nutrition

The use of soil organic amendments is now common place amongst cotton growers in some regions, particularly on the Darling Downs. CRDC's 2013 Cotton Grower Practices Survey showed 42 per cent of respondents from the Downs are 'always' including manures and composts in their nutrition program.

Growers who have been using these products over a period of time are confident there is a significant, positive effect on their soils which is helping to meet crop nutrient requirements (however measurement of these effects and putting values on the benefits has proven difficult to achieve).

Figure 5: Compost users. Proportion of farms using manures as part of a nutrition program (Source: Cotton Growing Practices: 2013 Findings of CRDC's survey of cotton growers).



Numerous research studies have shown that manures can improve not only the nutrient status, but also the physical properties and the organic carbon levels of soils.

However these studies, including local research looking at locally available products, have tended only to demonstrate soil benefits with application rates much higher than are logistically and financially sensible in Australia's cotton farming systems.

The benefits reported in association with low application rates have been more variable, so despite significant research effort aimed at clarifying the real impact of organic amendment use in cotton systems, there are currently few general guidelines available to farmers for making the switch from synthetic to organic products.

Despite the difficulties in measuring their impact, the uptake of organic products has continued to increase, driven mainly by grower's own observations of soil and crop performance, their practical experience and interaction with other, like-minded growers.

Products presently being used across the Darling Downs include biosolids, raw manures derived from cattle, chicken and piggery operations, composts of raw manures and composted gin trash, and other composted material from green waste.

Availability and price are the two main drivers of product use and explain why use amongst cotton growers is higher on the Downs and in Southern NSW compared to other cotton regions.

For more information, visit the CottonInfo soil health webpage: www.cottoninfo.com.au/soil-health.

