Case Studies

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Contents

1.0 Biological Soil Amendment and Soil Carbon Improvement

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Region	:	**Burdekin Qld**
Land Use	:	**Intensive Vegetable Farming**
GPS Reference	:	**19 42.916 147 16.154** **19 43.371 147 16.029**

Fig 1_Data Summary

Date of Sample	:	12 Nov 2009	
Treatment Start	:	Oct 2006 (3 Years prior)	
Location of Farm	:	Burdekin River Plain	
Land Use	:	Intensive Farming	Vegetables
Predominate Soils	:	"Burdekin Sand"	Unstructured Sand
Climate	:	Dry Tropics	

	Unstructured Sand	Treated Soil	Change
Soil Structure	Fine Sandy Loam	**Silty Loam**	
Total Organic Carbon	0.35%	**1.13%**	**0.78% of Soil Mass**
Tonnes Carbon/Ha	1.5 Tonnes/Ha	**16.95 Tonnes/Ha**	**11.7 T/Ha**
Change Per Year	(Per Hectare Annualised)	**Rate of Carbon increase**	**3.9 T/Ha/Annum**
Available P	67.6 mg/kg	**242 mg/kg**	**+258%**
Water Holding at Sample	5.3%	**12.9%**	**+143%**
Savings in Fertiliser	200 kg P/ha 180 kg N/ha	**110 KG P/ha** **134 kg N/ha**	**-45%** **-26%**
2008/2009 Fertiliser Cost	$900/ha	**$545/ha**	**-$355/ha**

Fig 2_Soil Structure

Program Description

A program of soil amendment using recycled vegetative matter and incubation of specific soil inoculants was conducted over a three year term from 2007 to 2009. It has been postulated that biological soil amendments as part of a program of changed land management do nothing to bring about improvements in total reserves of soil carbon and therefore represent merely an extra cost to farmers (Grace et al 2008 and 2009). It has also been suggested that building humus and other soil carbon in soil requires additional fertiliser input and will therefore cost farmers money by causing capture of inputs they pay for (Passioura et al 2009 and 2010).

This program set out to test these hypotheses and to ascertain the relative cost/benefit relationship accruing from changed land management practices including biological amendments aimed at development of an improved soil carbon reserve. The program specifically implemented changed land management practices around the quantum of use of chemical fertiliser inputs and tillage practices and the inclusion of biological amendments in an intensive vegetable farming operation and measured impacts on global operative elements (gross yield and total input costs per hectare) and specifically on soil carbon enhancement. The farmer was particularly interested initially only in building soil carbon and the impacts of biological amendments on this. He saw improved soil carbon reserves as more important than cost factors. However, as the program progressed it became obvious that reductions in input costs were also very important to the operation. The program took the view that the total cost of inputs, including soil amendments in treated zones should not exceed those in control zones. Discrete production zones were identified which allowed specific comparison of land use methodologies in a defined area while monitoring was also conducted at a range of sites located across an operation covering 300 hectares in total.

Control areas (having no change in land management practice) were maintained. Crop yields were compared over the term and testing was conducted to measure soil values for Total Phosphorous, Total Organic Carbon, Total Carbon and Total Moisture. Product suppliers and agents were excluded from the testing process and all soil sample analysis was conducted independently by NATA approved laboratories.

Farming operations continued on both control and test areas unabated throughout the period and followed normal crop rotations and fallow cycles for the farming operation. Fertilisation and irrigation were both performed via trickle irrigation and were carefully monitored and managed throughout in line with normal procedures for such farming operations. Standard agronomic testing underpinned fertiliser usage patterns throughout the trial period in both control and test zones.

Data was averaged over treated zones and over control sectors to give sampling results. Representative soil sampling was conducted across the site and at GPS located sites on the property in both control and treated sectors.

Crop Yields:

Year	Gross Yield Control (Tonnes)	Tonnes/ Ha control	Gross Yield Treated (Tonnes)	Tonnes/Ha Treated	Difference
2007	166	20.5	229	28.3	**37.95%**
2008	162	20.0	174	21.5	**7.41%**
2009	258	31.9	298	36.8	**15.50%**
3 Year Average	195	24.1	234	28.9	**20.00%**

On average, crop yield improved in treated areas by 20% over the trial period. Tonnages are combined pumpkin, corn and beans to give total crop weight. Crop rotation within the period ensured a distribution of crop types across farm sectors over the period. While these results were pleasing for the farmer, it was considered that more detailed work should be done to show changes in yield in individual crops.

Input Costs:

Year	$/Ha control	$/Ha treated	Difference
2007	1606	1640	**-2.11%**
2008	1730	1730	**0.0%**
2009	1595	1205	**24.45%**
3 Year Average	1644	1525	**7.24%**

Treated Sector input costs include fertiliser and all other input costs together with the cost of manufacture of biofertiliser made from crop residues on site. This includes the collection cost of the organic waste and the input cost of the discarded fruit used to incubate bio-fertiliser. Cost of inoculants and other biological inputs is also included. Untreated sector input costs include fertiliser and all other input costs. A dramatic reduction in input costs was noted in the Treated Sector in year 3. While this was pleasing for the farmer, it was considered that more work should be done to identify specific areas (other than fertiliser alone) in which cost reductions have occurred. Of particular note was a dramatic reduction in the agronomic recommendation for application of Phosphorous on the treated sector particularly in year 3. At the end of the trial period, despite having reduced application of P to treated sectors to close to zero, a recommendation to apply no Phosphorous for two years to treated sectors was received. This factor represents a specific, measurable cost advantage arising from the program's implementation and provided the largest contributor to the cost savings of $355 per hectare in fertiliser alone which were experienced in treated over control sectors in the third year of the program. In total a 38% reduction in fertiliser usage was experienced in treated sectors over untreated sectors in the 3rd year of the program's operation.

Soil Structure change

A clear difference in soil structure and quality was noted over the term of the study (see figure 2). In line with the measured improvement in soil carbon reserves, a change in soil ped formation and in the prevalence of soil interspaces was obvious. This structural change was reflected in soil categorisation which moved from unstructured fine sandy loam to a silty loam over the three year term. Colour and texture of the soils also showed clear differences.

Secondary benefits which have accrued in treated sectors include an improved ability to hold moisture and conversely an increased ability to access and work soils immediately following heavy rainfall periods. It was noted that treated sectors could be accessed and effectively worked three to four weeks earlier than untreated sectors. Ponded surface water was observed to be considerably less in treated sectors while water retention in drier periods was dramatically improved.

Increased total biomass under some crops

Significantly increased levels of biomass were observed on treated sectors during pumpkin crop rotations. In pumpkin crops this was most evident where robust biomass was present at harvest on treated sectors to a height of approximately 900mm throughout. This vegetative matter was dense and in fact presented an imposition at harvest as it prevented visual inspection of the crop for harvest. A technique to manually knock down this vegetation was devised which was overlaid on standard harvest practices. Pumpkin vines at harvest were robust and still growing. Some ratooning was noted following harvest. A significant volume of vegetative matter persisted on the ground surface following harvest in pumpkin crops on treated sectors. This factor was not considered in overall input values for treated sectors, and it was recommended that more work should be done to ascertain nutrient contributions to subsequent crops from this biomass itself.

On untreated sectors, pumpkin crop vegetative matter was rarely above 300mm and was significantly less dense. Most vegetation and specifically pumpkin plants typically died off prior to harvest leaving minimal vegetative biomass on the ground surface at harvest. It was observed that the die-back of biomass on untreated sectors coincided with reduced soil moisture in these sectors later in the crop cycle. Soil Carbon reserves Soil testing and observable changes in soil structure and type confirmed a significant improvement in soil carbon reserves which occurred during the trial period on treated sectors. No improvement was noted in control sectors over the same period. It was significant that improvements in soil carbon were relatively consistent on all treated sectors and across the three year term regardless of differences in climatic conditions, precipitation and crop rotation throughout the period. Specifically, it was noted that the averaged increases in soil carbon were not more pronounced where pumpkin crops with higher biomass were grown.

The measured increase in total organic carbon across all treated sectors was significant and readily visible on even a cursory inspection of the property. Due to the low base of soil carbon reserves and the particular quality of the predominant soils of the area, combined with tropical climatic conditions, this increase in carbon was thought to be impossible and the farmer reported that all previous efforts to improve soil carbon on the site over the past 20 years had failed.

Key Land management changes

The key land management changes implemented on treated sectors only are described in the following table.

Practice	General Description
Reduced Tillage	Tillage was completed only once per year to 200mm depth. Weed Scratching to 30mm also performed at mid-cycle
Reduced Fertiliser	Minimum 30% reduction of fertiliser input – this varied
Input	year to year as to which element was reduced with Nitrogen reductions prominent in years 1 and 2 and Phosphorous reduction predominant Year 3 Maximum total reduction of 38% by weight was achieved in year 3
Addition of Bio-Fert	150 litres per hectare of Recycled crop residues incubating VRM Photon Seeder and VRM Photon Starter were used in each crop cycle
Addition of Inoculants	VRM XLR8 N and VRM XLR8 Ca were used at 10 Litres per hectare per season
Manual Bio-mass	A manual slashing of extended biomass in Pumpkin crops
knockdown	occurred at harvest. This involved cutting biomass with a wire rope towed between two tractors. Biomass was not collected from the surface.

Summary of observations

Soil texture and quality were obviously improved in treated sectors over the period. An observed improvement in water handling capacity of the soil (both during wet and dry periods) was of particular interest to the farmer. Early access to wet ground provided a significant benefit in ground preparation. Similarly, the retention of moisture during dry/drought conditions at harvest provided significant relief and allowed a reduction of irrigation on treated sectors. Measurement of the quantum of reduced irrigation was not an object of this study and it is recommended that this element be further explored in a future study.

A significant improvement in soil carbon levels was noted in treated sectors over the course of the study. This improvement is well in excess of rates of improvement thought possible in similar soils and in intensive cropping.
The improvement occurred equally in areas where extended biomass growth was observed and in areas where biomass growth was unchanged leading to a conclusion that while an improved soil carbon reserve may allow support of extended biomass in some crops, the biomass addition itself is not necessarily a requirement for improvement of the soil carbon reserve.
Global yields were at least maintained (and in fact improved) throughout the period on treated over untreated zones while global costs trended lower on treated over control zones as the program went on. This gives rise to a refutation of the premises put forward by Grace et al and Passioura et al on the grounds that:

- amendments were a key point of difference in management of treated over control zones
- addition of amendments did not result in either yield decline or additional cost and
- Soil Carbon reserves improved significantly following addition of amendments and not elsewhere.

2.0 Soil Enhancement versus Maintenance of Yield

Case Study: Viticulture

Soil enhancement processes have long been plagued by early-term yield losses as lower nutrient application and changes in land management practices are adopted. Prior studies have shown that low microbial counts and low microbial diversity are a feature of depleted soils and in particular of intensively farmed regions which have a strong reliance on applied nutrient. There is evidence to suggest that continued reliance on high rates of synthetic fertiliser prevents regeneration of the microbial elements which are critical to the in-soil processing of these same nutrients. This approach has fostered a cycle of increasing need for more nutrient in order to maintain yields. In an attempt to address this nexus, many landholders are seeking soil enhancement products which aim to help rebuild microbial diversity and biomass in soils. However, in most instances, farmers have been faced with accepting several seasons of lower yield or leaving land fallow altogether in order to promote microbial recovery in the soil.

This situation creates a commercial barrier for entry for most soil enhancement products, including those which involve the re-cycling or re-application of organic matter as a stimulant or a catalyst for in-soil biomass development.

In 2005 a solution was developed in North Queensland whereby highly adapted sets of organisms were pregrown on conventional fertilisers allowing a reduction of the environmental shock load faced by soil organisms when concentrated nutrients are applied to the soil. These formulations were then specifically adapted to allow the processing of key nutrients (N, P and Ca) and it was found that the introduction of formulations containing these key sets of organisms were able to supply a much faster development of soil biomass than had previously been possible. In addition, the sensitivity to concentrated nutrient was reduced, allowing farmers to manage reductions in the application of fertiliser over time rather than removing chemical inputs altogether in the early years of transition.

A simultaneous improvement in soil biomass and diversity of microbial development while in transition to lower fertiliser application and the use of organic inputs without the attendant yield losses provided an attractive solution for those landholders wanting to move to a platform of improved soil. Further impetus has been added to the discussion with the growing need for soil structure management (to prevent erosion and wind-blown losses) and for moisture retention. It has long been observed that soils which contain higher levels of humus – the result of microbial diversity and higher levels of microbial biomass – are better structured and retain water and nutrients longer in the zones where plants need them.

In recent times this discussion has become even more pertinent given the focus on re-deployment of Soil Carbon reservoirs which occur naturally as a result of increased biomass development. It became clear in 2005 that the process of adapted microbial re-deployment was, by proxy, a process which rapidly sequestered atmospheric Carbon.

In this study, a prominent farmer in the Riverina area of Australia sought to make the transition to lower fertiliser input and improved soil. The objective was to maintain yield by managing the input of both organic (soil enhancement) products and conventional nutrients such that improvements in soil health were achieved without yield decrease.

Property Details

Land Owner : Ken Hughes

Land Size : 800 ha including 2.8 ha of vineyards

Land Usage : Shiraz, Tempranillo and Chardonnay grapes

Fertiliser Used : VRM BioStart+ (a fermented soil inoculant aimed at early phosphorous processing) and VRM BioBase (a Bio-Fertiliser containing 7%N, 1%P and 4%K from conventional sources)

Dilution Rates : VRM BioStart+ 1:100 (water) and VRM BioBase 1:10 (water)

Nutrient Application Rates 2006 Crop:	
Urea	50 kg per ha
Phosphate	70 kg per ha

Nutrient Application Rates 2007 & 2008 Crop:	
VRM BioStart+	3 Litres per ha
VRM BioBase	200 Litres per ha

Method:

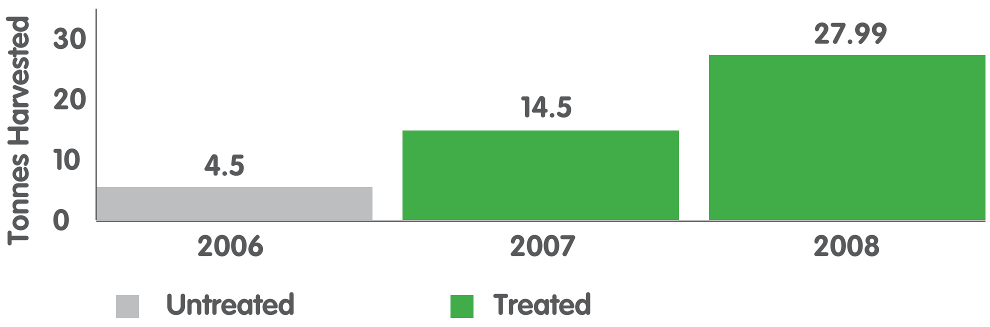
Over the course of the 2007 and 2008 growing seasons 2.8ha of grapes were tested to measure the production level and sugar concentration (Baume) achieved following adoption of a lower nutrient (fertiliser) regimen combined with selected soil enhancement products. Products were applied to grapes at three intervals from June onwards. Each of the products was diluted and applied through a Hardi boom spray rig as per the application rates listed above. Normal irrigation of the grapes continued throughout the years.

Yield Data

Grape	Year	Baume %	% change	Tonnes	% change
Shiraz	2006 (untreated)	14.0	–	4.50	–
Shiraz	2007 (treated)	14.1	+0.7	14.50	+222
Shiraz	2008 (treated)	13.5	-4.5	27.99	+93
Tempranillo	2006 (no crop)	nil	nil	nil	nil
Tempranillo	2007 (treated)	14.3	–	0.61	–
Tempranillo	2008 (treated)	13.5	-5.6	2.27	+272
Chardonnay	2006 (untreated)	13.5	–	0.32	–
Chardonnay	2007 (treated)	14.8	+9.6	0.65	+103
Chardonnay	2008 (treated)	14.0	-5.4	0.92	+41.54

Note: 2006 crop yield was affected by hail.

Shiraz



Organic Carbon Measurements

Year	Organic Matter %	% change	Total Organic Carbon
1998	0.3	–	0.18*
2005	0.93	+210	0.55*
2008	4.23	+355	2.42

Note: The vineyard was irrigated each year.

*Calculated Values.

Outcomes

Overall Grape production increased by 15.42 tonnes or by 98% between the 2007 and 2008 seasons upon adoption of lower nutrient regime coupled with soil enhancement. The Baume (sugar concentration) was maintained at approximately the same levels as achieved in previous years – in this case 13.7%.

Baume is a key element in yield determination for this farmer. Historically on this farm – as in most viticulture – an increase in volume of production will invariably mean a significantly lower sugar concentration in the fruit. In this case, significant increases in volume production were achieved without the attendant drop in sugar concentration. This result means that the farmer has been able to increase yield during the transition to a lower nutrient application without yield loss. Additionally the farmer has stated that improved flavour, aroma and texture compounds have been evident in the wines.

Improvements in soil structure and friability have been noted, together with much advanced water management. This mirrors an increasing pool of organic carbon measured in the soil over the period.

Case Study: Broad Acre Grain and Silage

Soil enhancement processes have long been plagued by early-term yield losses as lower nutrient application and changes in land management practices are adopted. Prior studies have shown that low microbial counts and low microbial diversity are a feature of depleted soils and in particular of intensively farmed regions which have a strong reliance on applied nutrient. There is evidence to suggest that continued reliance on high rates of synthetic fertiliser prevents regeneration of the microbial elements which are critical to the in-soil processing of these same nutrients. This approach has fostered a cycle of increasing need for more nutrient in order to maintain yields. In an attempt to address this nexus, many landholders are seeking soil enhancement products which aim to help rebuild microbial diversity and biomass in soils. However, in most instances, farmers have been faced with accepting several seasons of lower yield or leaving land fallow altogether in order to promote microbial recovery in the soil.

This situation creates a commercial barrier for entry for most soil enhancement products, including those which involve the re-cycling or re-application of organic matter as a stimulant or a catalyst for in-soil biomass development.

In 2005 a solution was developed in North Queensland whereby highly adapted sets of organisms were pregrown on conventional fertilisers allowing a reduction of the environmental shock load faced by soil organisms when concentrated nutrients are applied to the soil. These formulations were then specifically adapted to allow the processing of key nutrients (N, P and Ca) and it was found that the introduction of formulations containing these key sets of organisms were able to supply a much faster development of soil biomass than had previously been possible. In addition, the sensitivity to concentrated nutrient was reduced, allowing farmers to manage reductions in the application of fertiliser over time rather than removing chemical inputs altogether in the early years of transition.

A simultaneous improvement in soil biomass and diversity of microbial development while in transition to lower fertiliser application and the use of organic inputs without the attendant yield losses provided an attractive solution for those landholders wanting to move to a platform of improved soil. Further impetus has been added to the discussion with the growing need for soil structure management (to prevent erosion and wind-blown losses) and for moisture retention. It has long been observed that soils which contain higher levels of humus – the result of microbial diversity and higher levels of microbial biomass – are better structured and retain water and nutrients longer in the zones where plants need them.

In recent times this discussion has become even more pertinent given the focus on re-deployment of Soil Carbon reservoirs which occur naturally as a result of increased biomass development. It became clear in 2005 that the process of adapted microbial re-deployment was, by proxy, a process which rapidly sequestered atmospheric Carbon.

In this study, a prominent farmer in the Riverina area of Australia sought to make the transition to lower fertiliser input and improved soil. The objective was to maintain yield by managing the input of both organic (soil enhancement) products and conventional nutrients such that improvements in soil health were achieved without yield decrease.

Property Details

Land Owner : Ken Hughes

Land Size : 800 ha broad acre cropping and grazing

Land Usage : Cereal crops (Barley and Wheat), Silage and sheep

Fertiliser Used : VRM BioStart+ (a Fermented soil inoculant aimed at early phosphorous processing) and VRM BioBase (a Bio-Fertiliser containing 7%N, 1%P and 4%K from conventional sources)

Untreated Areas Fertiliser Used : Urea and DAP

Dilution Rates : BioStart+ 1:100 (water). BioBase 1:10 (water)

Application Rates to Treated Areas (incl water):	
VRM BioStart+	5 Litres per ha
VRM BioBase	100 Litres per ha
Cost	$78 per ha

Application Rates to Untreated Areas:	
Urea	50 Kg per ha
DAP	100 Kg per ha
Cost	$170 per ha

Note: Half VRM BioBase applied in Spring and half in Autumn.

Method:

Over the course of the **2005 to 2007 growing seasons**, whole paddocks of land were segregated to allow treatment of discrete blocks of grain (refer 'Production Data'). On this farm, during better years, grain is harvested while during poorer years, silage is harvested from the same ground. Accordingly, the overall tonnage of production is an important indicator of yield. Production levels were measured to highlight the effects following the adoption of a lower nutrient regimen combined with selected soil enhancement products. Products were applied in late autumn to broad acre Barley fields prior to seedling emergence and again in spring.

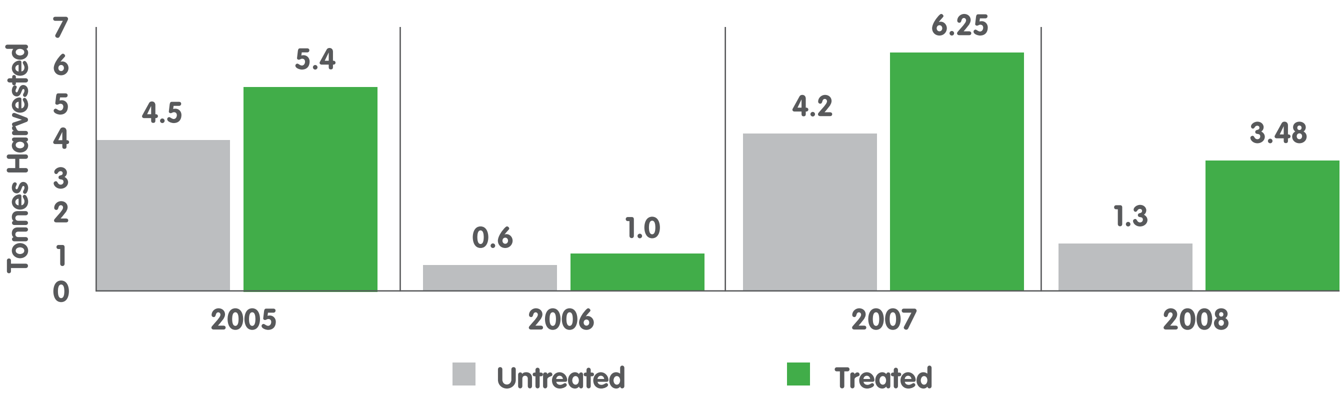
During 2006 and 2007 the farm experienced severe drought conditions in line with lower and poorly timed rainfall across the entire region. In 2007 the farm produced silage rather than harvest a poor grain crop. In 2008 rainfall occurred late in the season with severe losses experienced on adjacent properties and untreated areas as a result.

Comparisons are made between treated and untreated areas of the farm, being areas where biological products were applied (treated) versus those where chemical inputs only were applied (untreated). Buffer areas were left around the treated areas to ensure separation of treated and untreated zones.

Production Data

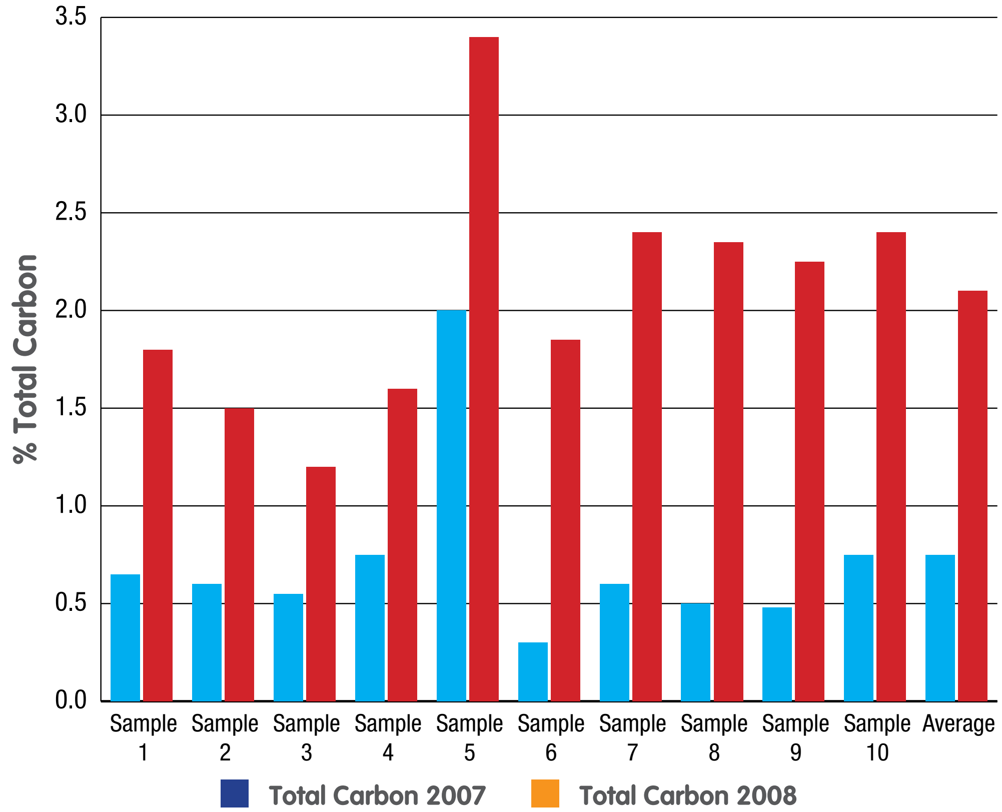
		Untreated Areas			Treated Areas			
YEAR	RAINFALL (mm)	PADDOCK SIZE (ha)	YIELD TONNES/ha	BRIX % READING	PADDOCK SIZE (ha)	YIELD TONNES/ha	BRIX % READING	INCREASED TONNES %
2005 Barley	581	30	4.0	–	**50**	**5.4**	**–**	**35**
2006 Barley	183	30	0.6	–	**50**	**1.0**	**–**	**67**
2007 Silage	455	200	4.2	–	**40**	**6.25**	**–**	**49**
2008 Barley	489	100	1.3	5.8	**300**	**3.48**	**11.8**	**168**

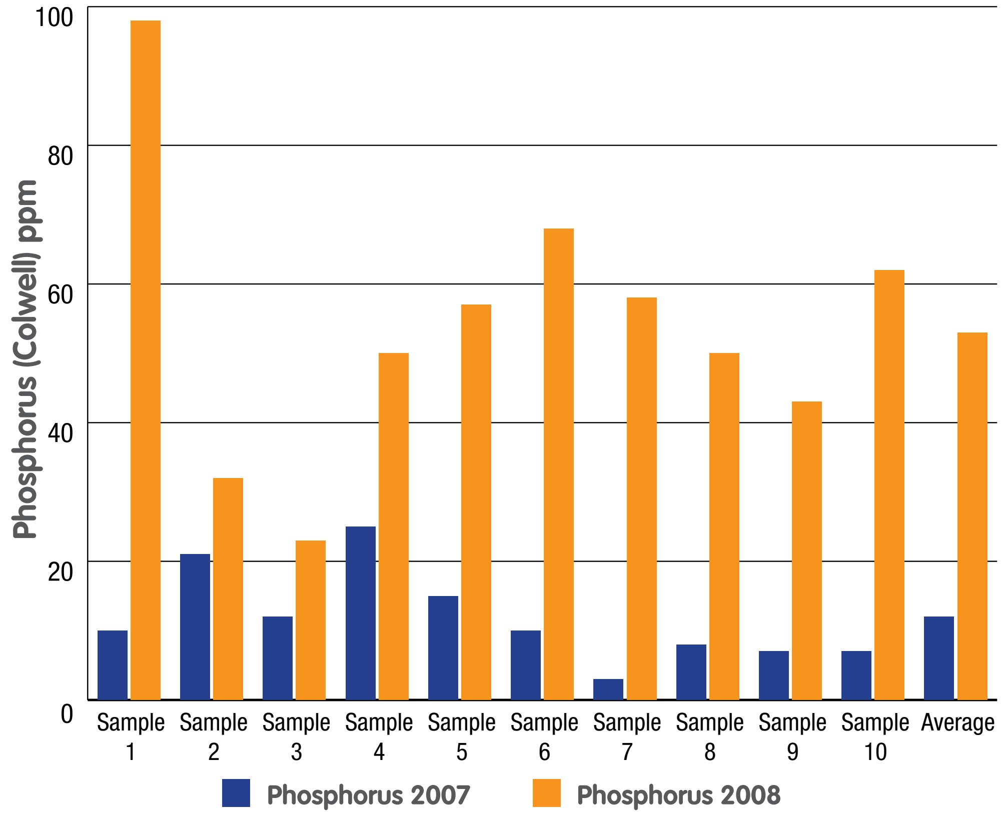
Improved soil structure and significantly increased moisture retention were observed in treated areas as shown in the photographs following. Soil on this farm is predominately a gravel loam/clay which over time had become relatively structureless and which held moisture poorly. The soil typically dries out to a fine light dust in dry periods and forms a structureless clay in wet periods. In the treated areas a rapid re-development of structure was observed over the three years with concurrent extended plant root development and higher levels of organic carbon measured. BRIX (sugar) readings in the treated areas were measured at or near 11.8% compared to 5.8% in untreated areas testifying to a higher nutrient uptake and greater pest and disease resilience in treated areas.



Yields verified by Peter McLaughlin, Riverina Co-op, Wagga Wagga.

The clear benefits outlined by these trials have been the catalyst for the property to adopt a lower nutrient regimen combined with selected soil enhancement products over the entire property for the **2008 growing season**. Recent widespread soil tests conducted by Charles Sturt University have highlighted significant improvements in the soil's biology particularly in relation to Total Carbon and Phosphorus levels achieved
as per the following charts:





Note: these results are backed up by a 2005 NSW DPI report 'Microbes & Minerals' stating "Building soil organic matter helps to build the organic pool of Phosphorus". Phosphorus and other minerals are made available to the plants in the wake of enhancement soil microbial activity.

Samples taken in late winter showed strong increases in levels of available Phosphorous, despite low rainfall and cold weather. This higher nutrient availability is mirrored in significant increases in soil organic matter and in Total Carbon fractions.

Total Carbon increases in excess of 1.3% have been recorded in treated areas during the 2008 growing season. While areas of lower background carbon had proportionately higher rates of increase in both available Phosphorous and Total Carbon following treatment, it is important to note that the trend of increased biological activity is consistent across the property.

Examples of improved soil structure and moisture retention in treated versus untreated Barley crops. The higher Organic Carbon levels have transformed the previously structureless loam/clay. Greater levels of nutrient have been delivered to the treated plants via the significantly improved root structure.

Outcomes

Overall production tonnages were consistently and significantly higher in the areas treated with bioproducts over those left untreated for the term of the study. This result was surprising given the adverse growing conditions experienced throughout the period and the much lower nutrient regime employed on treated areas. Input costs of the biological soil enhancing products were less than half that of the chemical fertiliser inputs.

Similarly, a significant growth in soil organic matter and a commensurate improvement in soil organic carbon and moisture retention were noted in treated areas despite the farm experiencing severe drought. Dramatic improvements in available Phosphorous were observed in treated areas. This was particularly pertinent in the region in which the farm is located where landholders typically struggle to maintain levels of available Phosphorous despite high levels of applied P (as seen in untreated areas of this study where standard application rates were used). In this case, treated areas had applied P of approximately 1 kg per hectare. Untreated areas received applied P of approximately 20kg per hectare. Despite the large disparity in applied nutrient, treated areas showed much higher available P levels throughout the growing season.

Improvements in soil structure and friability have also been noted. This mirrors an increasing pool of Organic Carbon measured in treated soil over the period. Further measurement of these factors is anticipated for following seasons with the Soil Enhancement Program being applied to the entire property.

3.0 Bio-Accelerated soil management a hit

The benefits of a balanced management program which includes biological products was the focus of a recent farm visit by a group of growers in the region. The group set off from Kalcane headquarters armed with a healthy dose of scepticism and show-bags containing information on a range of products currently in use on the Haselton farm in Clare.

Along the way, some details were given as to what exactly has been done on the farm to manage a change in the structure and water holding capacity of the soil over a four year period. Growers spoke to Neville and Max Haselton and heard how they had committed to a long term program to boost the biological support to their existing growing regime. The message was that nutrient is always needed, but that a focus on also including good biological management has meant that the nutrient is less prone to run-off and loss. In particular, the availability of P has increased substantially. The farm has recorded a gradual increase in soil carbon levels over the past three years and the benefits of this in what was unstructured fine sand were evident to all visitors.

A video showing widespread use in South Africa of some of the same products was also shown and growers heard from Robert Ahern who has recently returned from a visit to South Africa to find out more of what was being done there. Robert related his surprise to find that the products being used in South Africa were made from ingredients shipped originally from VRM in Townsville – the same products which have been used on the Haselton farm. A presentation was also given by Awie DeSwardt (formerly of BSES in Proserpine) who previously managed large cane holdings in South Africa using similar methods. Neville Haselton cautioned participants not to be looking for a "silver bullet" solution. "You have to be willing to stay with it" he said. "We were ready to give it away after the first couple of seasons, even though the cost of inputs was a bit lower. But the build-up in the soil carbon convinced us to continue and now we are seeing real changes in soil quality and water holding. And our cost of P has dropped dramatically. On some parts of the farm our soil tests are showing we don't need to add P this year because of the increase in available phosphorus."

For more information, please contact: Burdekin Mill Products 0428 835200 or VRM Pty Ltd 47746337

4.0 Water Retention in Sandy Soils following Inoculation with VRM products

Property Location : Clare Road, Ayr Queensland

Property Owner : Robert Ahern

- Aggregate samples were taken in three locations on each of two paired blocks of sugar cane.
- Crops were planted at the same time and were of the same ratoon and variety.
- Each block was 2.2 ha in size and contained 48 rows of sugar cane planted at 1.524m centres.
- Rainfall on the blocks was identical and neither block received irrigation in the four weeks prior to the sample dates.
- All irrigation prior to the trial period was identical from the time of planting onwards. (a period of several months)
- Sample depth was 150mm.
- Soil type across the site is a sandy loam with some gravel intrusion.
- Both areas received identical applications of nutrient. Treated areas also received a spray application of VRM XLR8 n, XLR8 p and XLR8 cal at the rate of 8 litres per hectare of each product. Total application including water used for dilution was 300 litres per hectare. Product application was completed 4 months prior to sampling.

Samples were taken at weekly intervals over a three week period and aggregated for an average indication of total soil moisture by percentage of mass.

Untreated Area				Treated Area			
Sample	**Wet (g)**	**Dry (g)**	**% Moisture**	**Sample**	**Wet (g)**	**Dry (g)**	**% Moisture**
1	179.7	161.7	11.13	1	194.45	174	11.75
2	194.57	171	13.78	2	192.57	168.44	14.33
3	203.59	182.94	11.29	3	203.1	177.3	14.5
Average moisture			**12.07%**	**Average moisture**			**13.53%**
Total water per Hectare (KL)			**181.05**	**Total water per Hectare (KL)**			**202.95**

Treated Areas showed increased water retention in the upper soil profile of 21.9 KL (21,900 Litres) per hectare.