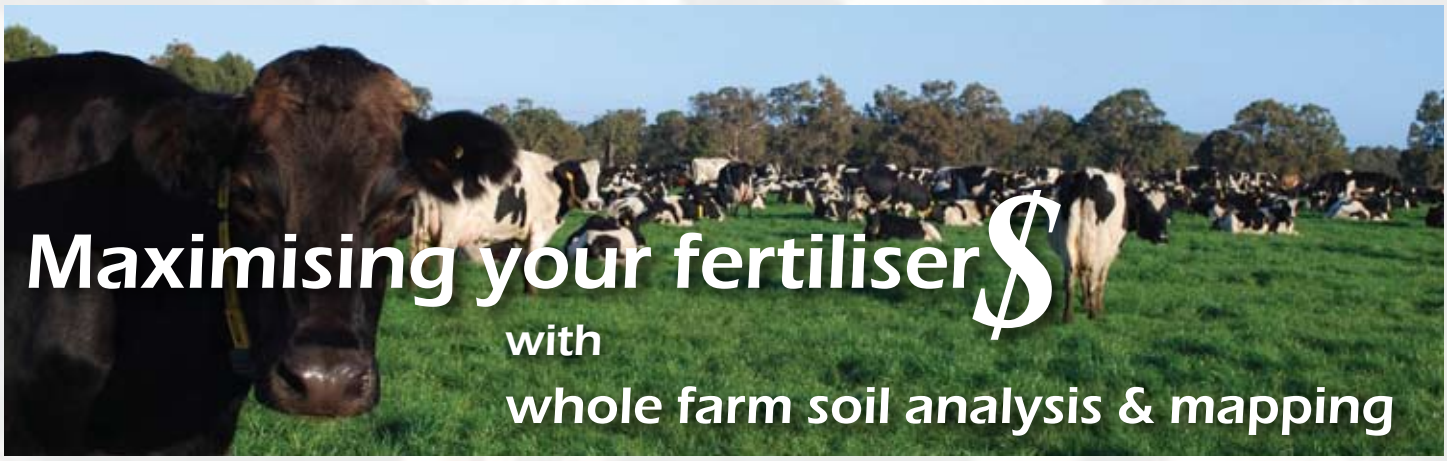


Maximising your fertiliser $ with whole farm soil analysis & mapping

Introduction

With fertilizer inputs accounting for the third highest input cost on dairy farms, after supplements and labour, it is critical you monitor and manage your fertilizer requirements. Whole farm soil analysis is a useful tool to accurately measure the nutrient status in your paddocks to enable increased efficiency in fertilizer applications with reduction in input cost. It involves testing each paddock or groups of paddocks based on management practice/soil types on your farm for, at least, the minimum of pH, phosphorus and potassium.

The 'Nutrient Management Systems for Dairying (NMS)' project run by Western Dairy and Dairying for Tomorrow, and funded by DAFF, demonstrates that the cost of intensive soil whole farm soil analysis was offset by the reduction in the amount of fertilizer used. In addition, matching fertiliser application to soil nutrient levels and pasture production is a more efficient use of fertilizers.

The NMS project piloted 12 farmers (11 dairy and 1 beef) in the Busselton, Cowaramup and Scott River regions. The farmers received a whole farm or up to 40 paddock soil analysis(with 30 samples per paddock) and report, together with a whole farm map showing pH, Phosphorus and Potassium and a nutrient budget.

The Farmer case studies demonstrate different approaches to on-farm change in fertilizer management as a result of the NMS project:

The fertilizer product and application were matched more precisely to the soil nutrient status and production; in 3 out of the 4 case studies, the result was a decrease in fertilizer use and subsequent costs.

For some farmers there was no immediate saving in fertilizer costs, but a potential for increased fertiliser efficiency from redistributing fertiliser to target areas of low soil nutrient levels, while less or no fertiliser was used on areas of high soil nutrient levels.

In addition, the project highlighted the need to address pH. Plants perform best in the pH range of 5 – 5.5, where the nutrients become more available to the plants. In the project, some farmers used the reduction in fertilizer cost to increase the application rate of lime or other soil amendment; a win- win situation, as in time this could further decrease the fertilizer requirement as the pH reaches the optimum range, maximizing nutrient uptake by the plants.

The improved fertilizer management will have a positive impact on productivity of a farm; it will also have a positive impact on the environment, especially the decrease in the amount of diffuse pollution (nutrients) entering the waterways. There are increasing pressures on the Dairy Industry in WA to minimize the Industry's impact on the environment; this project demonstrates the commitment of the Industry to be proactive in attaining positive environmental outcomes.

How much does it really cost??

1. Soil Collection (for 30 samples per paddock)
   8hrs x $25 = $200
2. Soil testing
   @$40/paddock: 40 paddocks = $1600
3. Consultant (includes farm nutrient maps)
   9 hrs @$150/hour+cost = $1500

Total = $3300

[It is recommended that whole farm soil testing needs to be done every 3rd year – based on this, soil testing cost are written off over 3 years]

Savings based on Neill's case study

Savings in 1 year		= $8,828
Savings over 3 years assuming no change in fertilizer programme		= $26, 484
Savings over 3 years minus the cost of whole farm soil testing		= $26,484
	[minus] -	$3,300
Total Savings		**= $23,184**

DairyingForTomorrow

CARING FOR OUR COUNTRY

Government of Western Australia
Department of Agriculture and Food

Case Study 1

Potassium applications halved :
Oscar, Wendy & Oscar Jnr Negus, Tutunup WA.

"I only have to save a few tonnes of fertilizer to cover the cost of soil sampling". ~ Oscar Negus Jnr.

"The whole farm soil testing has allowed us to further fine tune our fertilizer requirements without compromising our productivity.We will continue to whole farm soil test annually". ~ Wendy & Oscar Negus (snr).

- Rationalise lime application ,only applied where needed – reduced costs
- Identified salty areas which need gypsum applications
- less K was needed on the dryland reducing K cost by $14,000

Negus Enterprises run a large dairy operation at their home property. Associated with this home property are adjacent blocks & lease country on which stock is run or fodder conserved.

General nutrient practice has varied between dryland and irrigated country. Autumn dressings with early season N applications in some seasons, occasional winter dressings of N and spring applications to both grazing & fodder conservation areas is common on dryland pastures.

Irrigated pastures have received post grazing dressings of NP or NS blends. Generally 2 potassium (K) applications are applied in winter, as irrigation water usually contains high levels of K.

Annual soil testing is an integral part of farm management. Soil types have been the major determinate of where samples are taken, and these locations have been GPS located. Some areas are sampled every season to monitor trends and other locations are sampled in rotation.

Soil testing is used a management tool to assist in farm management decisions such as managing soil acidity. Plant tissue tests compliment soil testing and help determine nutrient status, pasture requirements and validating current fertilizer practice.

The Neguses apply their own fertilizer and machinery is maintained and calibrated accordingly. The scale of this enterprise sees a large amount of supplementary feed imported onto the property during the drier months of the year which contributes to whole farm nutrient input.

Rotational grazing based on leaf stage (2 3/4 to 3 leaves) is employed to maximise pasture quality and quantity characteristics. Smaller paddock sizes and the use of hot wires allowing stocking pressure to be maintained.

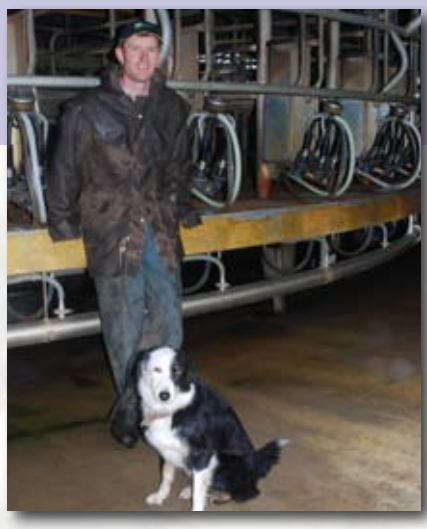
Potassium

Previous soil testing on the property had shown the K status of the soils to be marginal. The partial soil testing (ie not whole farm) employed at that time, made the assumption that similar paddocks were similar in soil type and nutrient status; based on this K was applied with all fertilizer applications.

For the project, each paddock was tested intensively, providing greater detail into the nutrient status. The project whole farm soil tests showed a higher concentration of K in the paddocks previously not tested. As a result, K fertilizer was applied every second fertilizer application, thus halving K costs.

Case Study 2:

Re-distribution of Nutrient:
Brynley Jenkins & Family, Cowaramup WA.



"tquote needed for herequote needed for herequote needed for herequote needed for herequote needed for herequote needed for herequote needed for here". ~ Brynley Jenkins.

- Brynley reduced the fertilizer applications on high nutrient status paddocks - e.g. around the dairy. This enabled a high application rate to be put on the poorer paddocks at no extra costs.

Brynley Jenkins and his family run a dryland dairy farm at Cowaramup. The milking platform "Fairview" is run in conjunction with run off blocks in the area.

General nutrient practice has been autumn, multiple winter, and spring applications to maximise pasture growth during the growing season. All fodder conserved on the property is consumed on the property. Additional fodder is also sourced from outlying land when required.

Partial soil testing is used a management tool to assist in farm management decisions. Brynley grouped the soil tests, with two thirds of samples are based on soil types, whilst the remaining samples are used as a diagnostic tool on problem or poor performing areas. Plant tissue tests compliment soil testing and help determine nutrient status, pasture requirements and validating current fertilizer practice.

Contractors and own machinery is used to spread fertiliser and soil amendment products. Brynley's machine is calibrated as per the owner's manual. In the past, Brynley has also used a nutrient budget to aid in fertiliser management decisions.

Rotational grazing based on leaf stage (2 3/4 to 3 leaves) is employed to maximise pasture quality and quantity characteristics As more pasture (particularly ryegrass) is allowed to grow above ground, this leads to a larger root system which results in improved nutrient use.

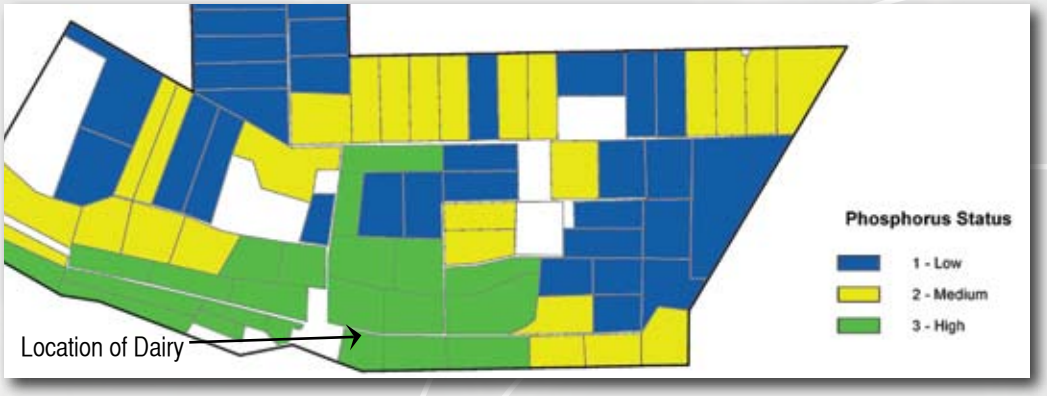
The partial soil testing on Brynley's property made the assumption all other paddocks were of similar or the same nutrient levels, consequently the fertilizer programme was based on a 'best fit' approach for potassium and phosphorus

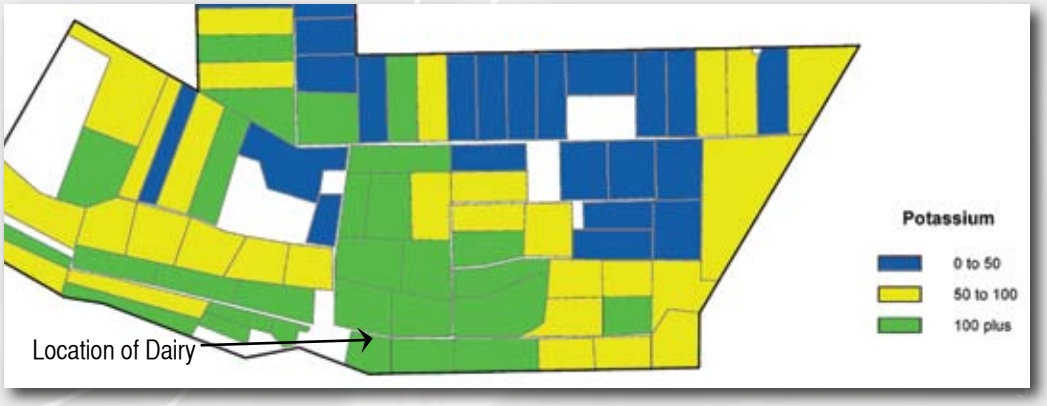
The whole farm soil testing employed during the project has demonstrated considerable variation across the farm. This is highlighted in the nutrient maps for P and K. The trend shows a decrease in the nutrient levels of P and K with increase distance form the dairy. This trend correlates with the degree of supplementary paddock feeding of the cows, resulting in paddocks closer to the dairy having more nutrients added to the soil, both from the feed and excrement, building up over several years.

Recognising the contribution of supplementary feeding areas to the nutrient levels of the soil, Brynley revised his fertilizer practices.

Brynley reduced the fertilizer application to the paddocks of higher nutrient status and focused on the nutrient status and management of poorly performing paddocks; this has reduced his fertilizer application in the autumn. Brynley has been able to make these decisions with confidence, based on factual information provided by the whole farm soil testing

The change in his fertilizer management practice has also reduced the risk of loss due to nutrient overload; this benefits the cash flow and also has a positive input on the environment, reducing nutrient losses to the waterways with a long term plus for water quality.





Case Study 3:

Savings in Autumn Fertiliser Spend:
Colin, Phyillis and Dwayne Neill, Boyanup WA.

'The project has heightened our awareness of how the nutrients vary across our farm; this has changed the way we apply our fertilizer and has overall reduced our fertilizer costs.'The whole farm nutrient maps were really useful" ~ Phyllis Neill

- On 86ha,the P rate was reduced by 11kg/ha
- Another 25ha , P rate was reduced by 5kg / ha
- Total savings on P fertilizer = $4,400
- Further reductions were made on K fertilizer
- Total savings $8,828

Laureldene Farms is a family run dairy, milking on the home property and also running a further run off block and a lease property. Milk production is around 1,500,000 L annually from approximately 200 cows.

General nutrient practice has been autumn, multiple winter and spring fertiliser applications to maximise pasture growth during the growing season. Supplementary feed in the form of grain and silage for the milking herd is fed over the summer months. All fodder conserved on the milking platform is consumed on the milking platform. Additional fodder is sourced from outlying land.

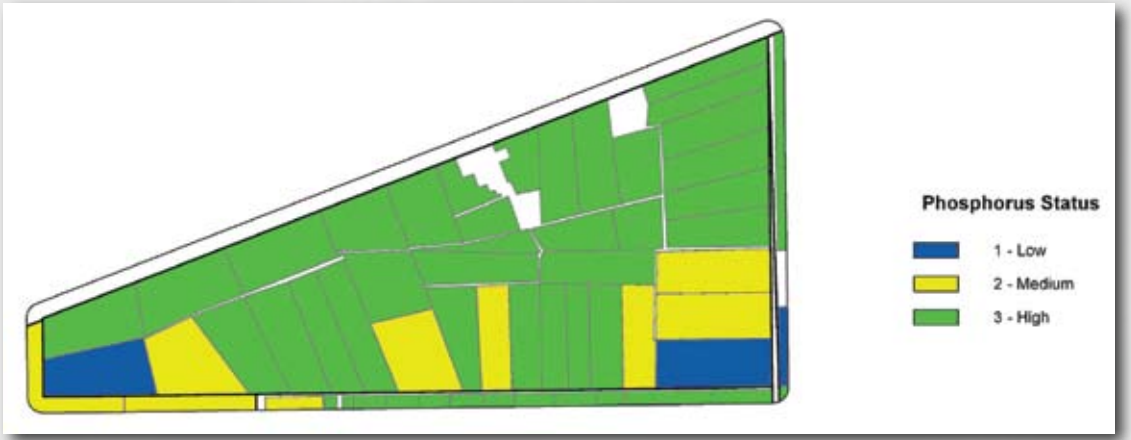
Partial soil testing is used a management tool to assist in farm management decisions such as managing soil acidity and lime applications; it has been carried out on an annual basis on a select number of paddocks. Plant tissue testing has not been used. Contractors are used to spread bulk fertiliser & lime on the property during the autumn and smaller applications are done with own machinery during the season.

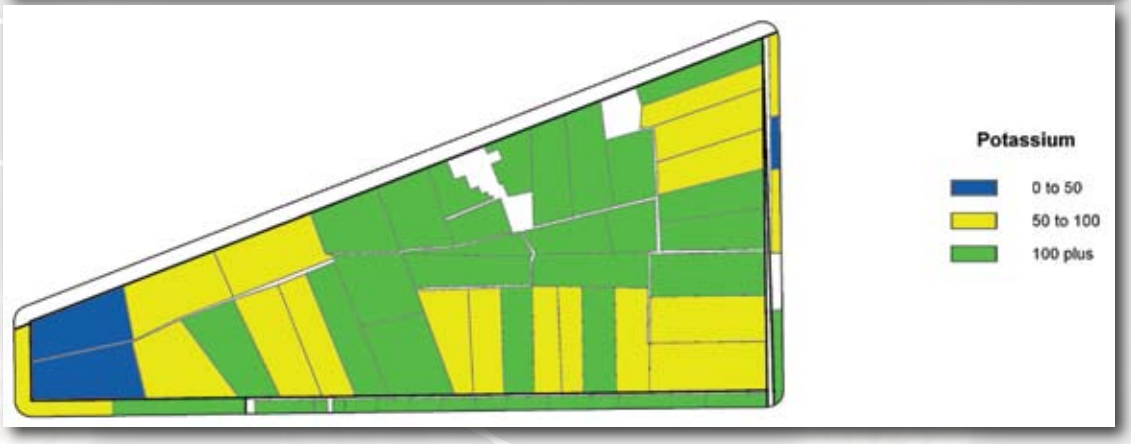
Rotational grazing based on leaf stage (2 3/4 to 3 leaves) is employed to maximise pasture quality and quantity characteristics. Average paddock size is around 4ha, therefore the smaller paddock size and less frequent grazing lends itself to better pasture recovery post grazing due to increased rest periods between grazing events.

Traditional Autumn Practice

Under the previous partial soil testing strategy, only a few paddocks were tested; the results were used to determine the autumn fertilizer.

The small sample number did not accurately reflect the nutrient variation across the whole farm. Hence the resulting





fertilizer applications tended to be based on a 'best fit' of:- Nitrogen, Phosphorus, Potassium and Sulphur, with approximately 29 N, 16 P, 25 K & 18 S applied per hectare across the milking platform.

His strategy was convenient and timely at the break of the season, but did not take in to account the nutrient variability across the farm.

Phosphorus

The milking platform is 144ha in size of which:

- 86ha only needs the low rate of Phosphorus (5kg P/ha) a saving of 11 kg/ha of P. Phosphorus costing $4.50 a kg (2009 prices). This equals a saving of $45/ha on P on these 86 ha or around $3870.
- Another 25ha should receive 11 kg P/ha, saving 5 kg/ha P at similar pricing equals $22.50/ha or $562.50 over the 25ha.
- The balance of country requires a similar rate of P to traditional practice.
- Total saving on phosphorus is ~$4400.

Potassium

Potassium applications would have been 25 kg/ha of actual Potassium (K) over the 144ha.

Only 37ha of the 144ha (25% of the area) has soil K levels low enough to warrant an application of Potassium in the autumn. Current Potassium (2009) pricing is around $2.50 per kg. Eliminating 25 kg/ha x $2.50/kg x 144ha = $9000 that is usually spent on potassium. For the 37ha that needs potassium, only 15kg Potassium is required for the autumn / early winter. 37ha x 15kg/ha x $2.50/kg = $1387.50. $9000 less $1387.50 = ~$7600 saved on potassium.

Savings

Add the $7600 saved on potassium to the $4400 saved on Phosphorus and the total save on a nutrient basis is $12000. Some of the money saved on potassium in the Autumn will be spent in the spring, but then they would have already put potassium on hay country at this time, so some of this Autumn saving is transferred to the spring and additional money does not need to be found.

The money that would have been spent on nitrogen would still be spent at some stage. There may be some extra spreading costs with some country being driven over twice (37ha of country that needs Autumn potash), but this would still be a large saving compared to the flat rate of using 200kg Dairy per ha over the whole milking platform.

Cost summary

Traditional Program

Product	Rate (kg/ha)	Quantity (Tonnes)	Total $*
Dairy	200	30	26,130

* May 2009 Pricing

Revised Program Based on Intensive Soil Test Recommendations

Product	Rate (kg/ha)	Quantity (Tonnes)	Total $*
Pasture Boost	Various	8	7,216
Muriate of Potash	30	1.5	1,896
NitroPlus	90	13	8,190
		Total $	17,302

**May 2009 Pricing*

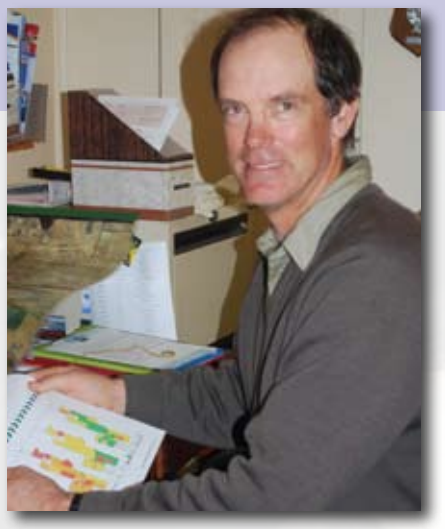
Traditional Program	$26,130
Revised Program	$17,302
Saving	**$8,828**

This revised program represents a 35% saving on the autumn fertiliser bill. Apart from some slightly increased logistics in relation to ensuring the fertiliser spreading contractors applied the correct rates in the correct paddocks, the implementation of the revised program has been relatively simple and the Neills are happy that the previous investments made in fertiliser over the years are now paying them back through enhanced soil nutrient status, particularly for phosphorus.

The saving achieved in the autumn fertiliser has also allowed the Neills to implement a liming program that may have otherwise been cut from the budget due to recent milk price reductions. Correcting soil pH will make a significant difference to the overall productivity and nutrient availability on the property, further enhancing pasture growth and potential milk yields.

Case Study 4:

Extensive Grazing – Ken and Liz Macleay, Blackrock Angus, Vasse WA.



"The whole farm soil testing has identified opportunities to decrease fertilizer applications - one of our biggest direct costs – with significant savings, allowing us to triple the lime application this year ... and still have some savings left over!" ~ Ken Macleay

- Saved $12,000 or $32/ha on fertilizers
- Savings used to increased lime application 3 fold to raise the pH
- Still save $500 after the cost of the lime

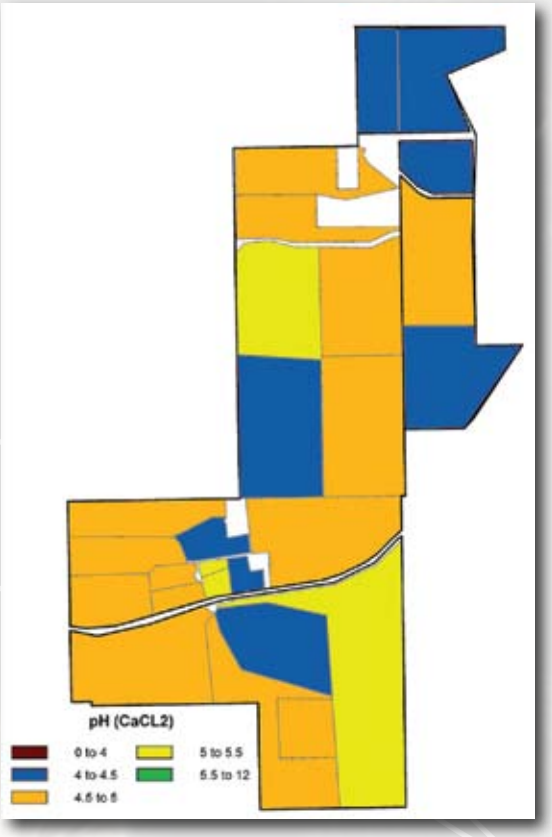
Ken Macleay breeds Stud Angus on his property at Vasse with the Stud Bulls the main commodity. The property is run as one block, with no associated outlying blocks involved. General practice has been autumn and spring fertiliser applications and some bought in supplementary feed for bulls prior to sale. All fodder conserved on the property is consumed on the property.

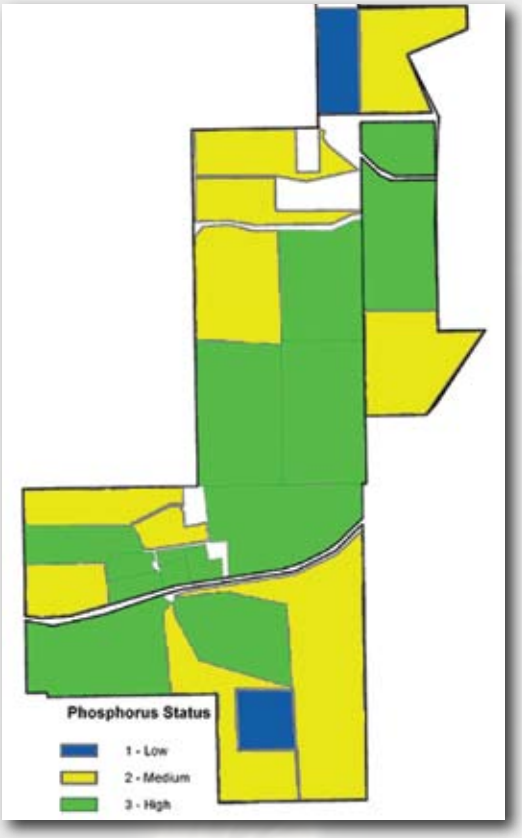
Partial soil testing is used a management tool to assist in farm management decisions , with a focus on fodder conservation areas of the property and managing soil acidity and lime applications;. Plant tissue tests have also been used to confirm plant nutrient requirements during the growing season for the last 4 to 5 seasons. Contractors are used to spread bulk fertiliser & lime on the property during autumn, while spring applications have been done with own equipment which is calibrated on farm.

Grazing regimes have been designed to accommodate a number of factors including breeding plans, paddocks required and feed on offer. This generally results in small paddocks being used, often with temporary hot wires. This smaller paddock design lends itself to better pasture recovery post grazing due to increased rest periods between grazing events, which in turn results in improved nutrient use by annual pastures.

Intensity of Testing Changes Practice

Ken regularly used 2 soil test kits (12 sites) per annum, returning to the same paddocks each year for sampling. These results were used to implement Ken's fertiliser program which in the past has been as much as 80 tonnes of Super Potash type product in the autumn and 40 tonnes of spring fertiliser.





Ken also limes a portion of the farm annually, working on a 5 or 6 year rotation of the property. Based on previous soil testing Ken has demonstrated best practice in fertilizer management.

The whole farm soil testing employed during the project has resulted in Ken revising and instigating significant management changes on his farm.

pH

Ken has recognised soil acidity to be a problem on his farm and has regularly limed each year. The whole farm testing highlighted pH to be a far greater issue than Ken initially realized. The whole farm pH map showed large sections of the property had a pH of less than 5.0(CaCl); with the current regime the target of 5.5 (CaCl) would be difficult to attain.

Ken increases his lime application this season from 100T annually to 300T annually. Raising the pH will potentially increase nutrient availability and pasture production associated with better root growth and nutrient uptake. Many of the low pH areas are those which Ken relies heavily upon for fodder conservation. As a large amount of conserved fodder is required to carry animals through the autumn and early winter periods, looking after these fodder production areas is a high priority for Ken.

Phosphorus

The historical fertiliser applications have resulted in Ken's property having good levels of phosphorous in the soil. For the paddocks of high P levels, Ken has reduced this seasons P applications to the minimum or none,. Last season, Ken applied 11 kg P/ha across the farm; this season Ken applied an average of 6.6 kg P/ha, a 40% reduction in P input, The P applications were targeted with areas of the farm identified with a low P status received 10 kg P/ha, whilst areas of the farm with historically better P levels only received 4.5 kg P/ha. Due to very high P levels in some areas, 5% of the grazing area received no fertiliser at all.

Based on 2009 prices, Ken's original P programme of 55T super Potash 5:1 would have cost ~$34,000 plus freight and spreading. With the revises strategy, Ken has spent $22,000 - a saving of $12,000 or ~$32/ha.

Inputs of K remain similar to the previous season.

This saving on the P fertilizer has financed the increase in lime application this year; even with the addition cost of lime Ken has saved $5000, but equally important, the new fertilizer and lime programme will have long term benefits on pasture productivity and of course the environment.

Notes from the Greener Pastures team

Priorities before considering applying fertilizer

The Greener Pastures project based at the Vasse Research Centre aims to provide dairy and beef producers with strategies to improve the efficiency of nutrients while reducing the environmental impact of intensive grazing systems.

Reduce soil acidification by applying sufficient lime to raise pH of the top 10 cm of soil to 5.5 or greater. This may require several applications of lime over several years if soils have been allowed to acidify to pH values of 4.0 or less.

Renovate pasture so it is dominated by clover and ryegrass.

Improve grazing management to use as much paddock-grown pasture as possible to produce milk and meat. Rotational grazing is required to improve use of paddock grown pasture for animal production. Pasture use for animal production is maximised by adopting the 3 leaf grazing strategy, by grazing when ryegrass plants in the pasture have 3 leaves per tiller. Better grazing management improves persistence of clover and ryegrass in the pasture.

Fertiliser phosphorus (P) requirements of pasture

For intensively grazed ryegrass pastures, only apply fertiliser P if soil testing indicates that the deficiency is likely to reduce pasture dry matter production for grazing. Soil P test calibrations relate soil test values to pasture dry matter responses to applied fertiliser P. Soil test values that relate to 90 % of the maximum pasture dry matter yield responses to applied P are called critical soil test values.

Soil test values below critical values are likely to be P deficient for pasture production and producers should discuss their fertiliser requirements with a FertCare accredited consultant.

Soil P test calibrations are strongly affected by the capacity of the soil to sorb P. In WA, reactive iron and the phosphorus retention index (PRI) were the standard methods for ranking the capacity of soils to sorb P, but Phosphorus Buffering Index (PBI) is now the new national standard procedure.

The Colwell soil test procedure is the standard soil P test used in Western Australia and much of Australia. Critical Colwell soil P test values are listed in Table 1 for different soil types in the region with different capacities to absorb P, as determined using either reactive iron, PRI or PBI. In Western Australia, the standard soil depth for soil P testing, and for reactive iron, PRI and PBI, is the top 10 cm of soil.

The best time to apply fertiliser P, for both clover ryegrass and intensively grazed ryegrass pastures, is 3 weeks after pasture has emerged at the start of the growing season (autumn application). Because ryegrass is better at accessing P from soil than clover, and better at using the P taken up to produce dry matter, the P requirements of intensively grazed ryegrass pastures is less than that required for clover ryegrass pastures. Consequently, yield responses of pasture to applied fertiliser P occur more often for clover ryegrass pastures than for intensively grazed ryegrass pastures.

Table 1. For the top 10 cm of different soils, P sorption capacity of soil and critical Colwell soil test P values.

P sorption category of soil	Reactive iron (mg/kg)	PRI (L/g)	PBI National Standard (no units)	Critical Colwell soil test P (mg/kg)
Very low	<100	-5 to 0	3 to 10	10
Low	100 to 300	0 to 2	10 to 20	20
Moderate	300 to 1000	2 to 10	20 to 40	30
High	1000 to 1500	10 to 25	40 to 60	40
Very high	>1500	25 to 50	60 to 150	50

Units for reactive iron and critical Colwell P are mg/kg = ppm

Useful websites

Greener Pastures

www.agric.wa.gov.au/greenerpastures

FutureDairy

www.futuredairy.com.au

Project 30 30

www.dairyextension.com.au/project3030.asP

Dairy Australia

www.dairyaustralia.com.au

www.coolcows.com.au

Western Dairy

www.westerndairy.com.au

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