


HILLnews

THE QUARTERLY NEWSLETTER FROM **HILL LABORATORIES → ISSUE No. 2**

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Hill Laboratories
BETTER TESTING **BETTER RESULTS**

WELCOME!

WELCOME TO ISSUE 2 OF HILLNEWS, AVAILABLE TO ALL CUSTOMERS USING HILL LABORATORIES SERVICES ON A REGULAR BASIS.

We'd like this newsletter to continue to be a useful information source for you and your business. To that end, we invite you to email through any suggestions for recommended future content.

Technical articles from some of our leading science professionals will be a regular feature, and we'll keep you posted on any new initiatives as we work hard to ensure we continue to provide you with the best laboratory services available in New Zealand today.

'ANY IDEAS?

We hope you enjoy reading HILLNEWS. If you'd like to see other areas of content covered – in particular certain technical areas – or you feel you have suggested improvements, please write to Martin Lovell at; martin.lovell@hill-labs.co.nz

We hope you enjoy this newsletter.

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YOU HAD YOUR SAY

And we thank you!

The results are in for the 2008 Hill Laboratories customer satisfaction survey. We had a great response with over 50% of customers surveyed taking the time to give us their insight into what it's like to be a customer of Hill Laboratories.

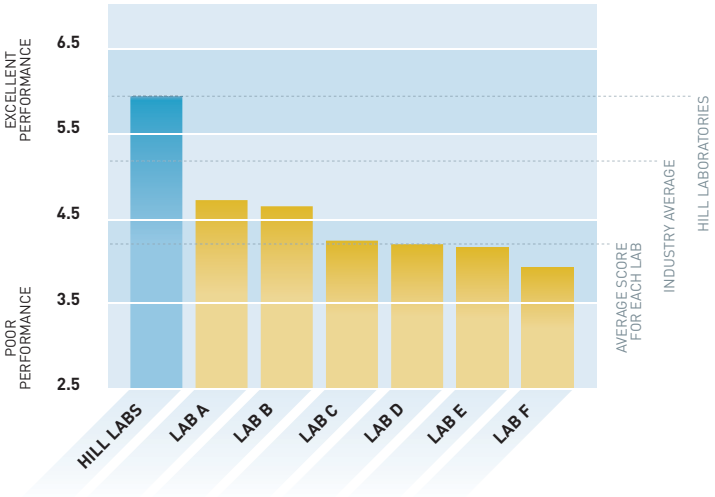
First of all - a big thank you to all of you that took time out of your schedule to send through this information. I want you to know that we have read each and every response you gave, reviewed them thoroughly and will now start to draw up plans for the future of our business using this information.

THE RESULTS OF THE SURVEY SHOWED

Overall we were extremely gratified to see how highly you regard our laboratory versus other competing laboratories. The overall satisfaction rating out of 7 (using a standard rating system)achieved for our laboratory was 5.6 versus 4.6 for our nearest competitor.

HOW OUR LABORATORY COMPARES

Performance rating scores that customers gave to each of the analytical laboratories they have dealings with



A review of customer responses told us that we achieved these ratings through technical excellence, reputation for quality, our accreditation and the quality of the customer services staff (our CSM's) that you interact with.

However the story doesn't end there. We have been able to identify some key areas to work on that will reinforce and strengthen our current position.

- One is changing the format of our invoices, making them easier for clients to understand and compare with our catalogue and/or quotes that we have provided them.
- Another is a continued focus on delivering on the promises that we make to customers with respect to the turnaround time of samples submitted, and communicating proactively with them if we are not going to deliver results on time.
- Clearly you also wanted to have more information about our products and services and in particular a more sophisticated website to be use when interacting with our business

Our focus now is to recognise the areas that you felt we perform well in. This will help us ensure that we maintain the performance and quality of these areas so that you can continue to take advantage of our high quality services but clearly a great deal of our focus will now go into delivering on the improvements that you have highlighted.

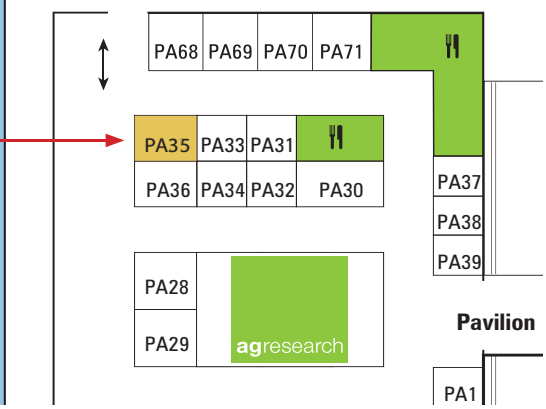
FIELDAYS 2008

THE SCIENCE OF FARMING

SEE YOU THERE!

THE 2008 NATIONAL FIELDAYS held at Mystery Creek just south of Hamilton is on the 11th-14th June. We have a new site and new location this year. You can find us at **PA 35, part of the Premier Feature exhibition held in the main pavilion**. We're looking forward to seeing you there!
Come along to our stand and talk to us about your specific testing needs.

Hill Laboratories
Stand No. PA 35
PREMIER FEATURE



AG NEWS IN BRIEF

If you deferred your autumn soil tests due to the dry conditions and plan to test this in early spring instead this year, please contact your fertiliser rep or farm advisor early enough to schedule the sampling in, so that samples can be processed smoothly. Wise use of fertiliser has never been more important so testing enough paddocks to gather whole-farm nutrient management information is essential for this.

Remember that our DIY sampling kits are available at your local merchant. The kits can also be obtained by simply phoning the lab or they can be ordered online at **www.hill-laboratories.com** These are particularly useful for small block holders and home gardeners. All instructions on sampling are included in the kit and you should be able to borrow an auger (corer) from your merchant. Results are reported in a simple-to-read histogram and while we do not provide any fertiliser advice your merchant rep can get that done too. In some areas, there are specialist small block consultants – email in for a referral.

Now that the eight regional Ballance Farm Environment Awards for 2008 have been announced you can find out more about these role models for sustainable and profitable farming on our website (follow link to www.nzfeatrust.org.nz). Hill Laboratories are national sponsors and present the Harvest Award annually – we would like to congratulate all entrants and encourage other farmers to put their names forward for this great event.

Ballance Farm Environment Awards
Promoting Sustainable Profitable Farming

Following quite a few queries about dry matter results for maize forage (pre-fermentation) this year in light of very dry growing conditions, we ran a quick interrogation of the results database. The table below will not be a surprise to anyone, and while no statistical significance has been calculated, these figures are from a reasonably large data set (excl Feb07 and May). Unfortunately not many customers ask for Starch to be measured on these samples – so the question of feed quality remains.

Ave. Maize Forage Results (DM %)

	2007	2008
Feb	34.3*	32.3
Mar	35.6	39.3
Apr	38.0	41.6
May	37.0*	44.4*

* <100 data points

AGRICULTURAL

SOIL QUALITY

ORGANIC SOIL PROFILE AND "CARBON ACCOUNTING"

'GOOD QUALITY' SOIL IS PRODUCTIVE IN THE AGRICULTURAL OR HORTICULTURAL PRODUCTION SYSTEM THAT IT SUPPORTS.

The requirements for 'productivity' are that the soil is efficient at retaining nutrients required for plant growth in a plant available form. Also, the soil must have suitable physical properties for drainage when excessive rainfall occurs and good water holding capacity so that plants can survive during dry conditions.

Hill Laboratories Basic Soil Profile includes chemical tests that are essential properties of good quality soil required for plant growth and microbial activity to ensure nutrient cycling; specifically pH, CEC and extractable 'inorganic' nutrients.

Additional tests correlated to soil quality are Organic Matter, Total Nitrogen and Mineralisable Nitrogen (Available Nitrogen).

- Organic Matter is calculated from the soil carbon content and consists of humus in addition to plant and microbial litter in various stages of decomposition. It is a key soil quality indicator correlated to soil water holding capacity, nutrient content and physical structure.
- Total Nitrogen (TN) is a component of the organic matter, including humus and partially decomposed plant and microbial biomass. The C/N ratio provides some information about the long term 'availability' of nitrogen.
- Mineralisable Nitrogen or Available Nitrogen (AMN or AN) is the amount of nitrogen likely to be released in forms that plants can use for growth during the current growing season and is correlated to soil microbial biomass and the partially decomposed litter fraction of the soil. This is described as the 'active fraction' of the OM and is associated with physical structure, water infiltration rate and fertility.
- The AMN/TN ratio indicates the proportion of the soil OM that will contribute to the supply of 'organic' nutrients to plants. This ratio is sensitive to management and environmental factors that deplete organic matter and affect soil quality such as cultivation and summer drought.

These 3 tests are offered as the Organic Soil Profile and provide a comprehensive assessment of both soil carbon and nitrogen status. This will be even more important as "carbon accounting" in agriculture becomes a requirement.

Additional information is available on Hill Laboratories Technical Note 'Assessing Soil Quality – The Organic Soil Profile'

SOIL NITROGEN TESTS WHAT TO ASK FOR!

The terminology around soil nitrogen tests is enough to tax the minds of even those of us in the business. We have provided the following definitions to help clarify the different tests and what they actually measure. The [bracketed] codes are what should be asked for on your analysis request form so that the laboratory does the right test.

Mineral N [MinN] is extractable Nitrate-N and Ammonium-N which generally comprises less than 1% of soil total N. The amount of mineral N in soil at any time is dependent on the 'supply' which is the rate of mineralisation of organic N compared to the rate of 'loss' which is absorption of N by plants or microbes and loss of N due to leaching or denitrification.

Where plant growth rates are rapid, Mineral N levels in the topsoil are likely to be low despite what may be a rapid rate of mineralisation.

Mineral N test results for topsoil (0 to30cm depth) are likely to be variable and only reliable for "point-in-time" samples. Mineral N tests on subsoil (60 to 90 cm depth) are less variable than topsoil tests, and indicate the amount of N that has previously leached or moved down the soil profile. This is used to estimate the N-supplying potential of the soil profile. Provided that there are no impediments to root growth, grass and cereal crop roots can utilise nutrients to these depths.

Samples for Mineral N testing must be chilled to less than 4 degrees C immediately after sampling and remain chilled or frozen until testing so that there is no microbial activity in the samples between sampling and testing.

Available N (Anaerobic Mineralisable N) [AN or AMN] comprises around 3% of total soil N and is determined by a laboratory procedure referred to as Anaerobic Incubation which speeds up the microbial mineralisation of organic matter. This test is used to estimate the amount of N that is likely to be available to growing plants during one growing season and reflects the amount of organic matter that is readily available to microbes as 'food' and its N content.

Total N [TN] is measured by combustion of the soil sample. Total N does not predict the quantity of N that is available to growing plants because it includes the N content of 'stable' humus. This test is used as a soil quality indicator and is included in the calculation of ratios such as C/N and AMN/TN which are microbial activity indicators.

AGRICULTURAL

FEED TESTING

GLOSSARY OF TERMS FEED TESTING

MANY DIFFERENT TECHNICAL TERMS ARE USED TO DESCRIBE THE ANALYTICAL TESTS COMMONLY CONDUCTED ON ANIMAL FEED OR FORAGE. THE FOLLOWING GLOSSARY WILL AID INTERPRETATION OF FEED TEST RESULTS.

Ash the percentage of the dry matter that remains after combustion at 600 degrees C consists of the mineral components of the feed. Levels > 12% in silage suggests soil contamination or composting has occurred.

Ammonium-N the amount of nitrogen in the sample tested that is in the chemical form of ammonium. This is a decomposition product of protein and a high level indicates poor fermentation. Virtually all of the nitrogen content of fresh forage is a component of protein.

Ammonium-N/Total N Ratio
the % of the protein that has decomposed. This value should be <10% for well-fermented silage.

Carbohydrates the % of DM that is NDF + soluble sugars + starch

Digestibility (DOMD)
the proportion of the organic matter content that is digestible or dissolves in a simulated enzyme treatment to replicate rumen digestion, reported on a dry matter basis.

Dry Matter the proportion of the fresh sample that remains after drying. The moisture content is 100-DM%

Fibre – Acid Detergent (ADF)
the proportion of the Dry Matter that is not dissolved by Acid Detergent treatment; this is considered to comprise of cellulose + lignin which are the strongest structural components of plant cell walls. High ADF content is associated with low digestibility feeds.

Fibre – Neutral Detergent (NDF)
the proportion of the Dry Matter that is not dissolved by Neutral Detergent treatment; this is considered to comprise hemicellulose + cellulose + lignin which are the structural components of plant cell walls.

Metabolisable Energy (ME)
the calculated energy yield of digestible dry matter which includes digestible protein, fibre, starch, sugars, fats and oil. This calculation assumes that animals are able to utilise all of the digested nutrients and that the diet is 'balanced' with no mineral, trace element or nutrient deficiencies and no metabolic stress.

Net Energy (NE) the estimated energy yield of digestible dry matter that is available to animals for maintenance and production considering efficiency of utilisation of dietary components and any dietary factor that reduces the efficiency of utilisation of ME. This is not commonly reported but ME is often confused for NE and pointing out the difference is important.

Non-Structural Carbohydrates
carbohydrate content of the DM that is not a component of cell walls; typically starch and soluble sugars.

Organic Matter (OM) is dry matter (DM) minus ash or the percentage of the DM that is lost through combustion; consisting of protein, carbohydrates and oil or fat.

pH (of silage)
a measure of the acidity created by fermentation of forage in the silage making process. Preservation of forage is achieved when acidic fermentation drops the pH to a level that prevents growth of 'spoilage' bacteria. Lower pH denotes better acidic preservation.

Protein – crude (CP)
calculated from the total nitrogen content of the feed; the standard conversion factor from % nitrogen to % protein for plant tissue is 6.25 (e.g. 2% N = 12.5% CP).

Starch
non structural carbohydrate that is not soluble in water. Starch content of feeds containing grain or vegetable tissue such as potato tubers is significant while the starch content of green leaf tissue is very low. A valuable component of feed as starch is rapidly digested by ruminant animals. However there is a risk of 'acidosis', which is a severe metabolic disorder, if the starch content of diets is too high.

Soluble Sugars
non structural carbohydrate that is soluble (dissolves) in water and is produced in green leaf tissue through the process of photosynthesis, moved through the plant in the sap stream and available for conversion into other forms of carbohydrate such as cell walls. A valuable component of feed as sugars are very rapidly digested by ruminant animals and also stimulate rumen function however there is a risk of 'acidosis' which is a severe metabolic disorder if the sugar content of diets is too high. Reject fruit has a high sugar content and has been linked to acidosis incidence when fed in large quantity.

Total Nitrogen
the laboratory test that is used to calculate feed protein content.

Volatile Fatty Acids (vfa)
produced through fermentation of soluble sugars by bacteria during the silage making process. The type of vfas formed reflects the type of bacteria that have been active during the silage making process.

VFA Lactic Acid (LA)
is the most acidic of the vfas formed by 'lactobacillus' bacteria. Forage is often inoculated with this type of bacteria at the start of the silage making process to increase the effectiveness of the acidic preservation process. LA breaks down in the presence of oxygen so compaction to exclude oxygen is essential.

VFA Acetic Acid (AA)
is the second most acidic of the vfas and is desirable in silage at around 1/3 of the concentration of LA. AA is slower to break down in the presence of oxygen than LA.

VFA Butyric, Propionic and Formic Acids are undesirable in silage if found in significant quantities and are evidence of either poor fermentation or poor storage of silage.

UNDERSTANDING BOD (BIOCHEMICAL OXYGEN DEMAND)

Introduction

BOD is an empirical test (ex APHA) which measures

- the molecular oxygen used by bacteria for the biochemical degradation of carbonaceous material (hence carbonaceous BOD or sometimes called CBOD)
- the oxygen used to oxidise inorganic material such as sulphides and ferrous ion.
- the oxygen used to oxidise reduced forms of nitrogen (nitrogenous BOD, NBOD) such as ammonia and organic nitrogen. This may be prevented by the use of an inhibitor (ATU) during incubation.

In practise a BOD test is often used in conjunction with a Chemical Oxygen Demand (COD) test to provide an indication of the oxygen demand, usually in a waste stream, effluent or surface water such as a river. If the oxygen demand is too high, all the oxygen in the water will be used up and living organisms will die.

Biochemical Oxygen Demand (BOD) is a test which requires a sample to have its dissolved oxygen (DO) content measured, be incubated under controlled conditions (20°C) for 5 days (hence BOD5) and then the DO is measured again.

The calculated drop in DO is the measure of BOD5.

The maximum concentration of DO in water at 20°C is about 7-9 mg/L (depending on barometric pressure and sample matrix).

Comparing BOD5, COD & TOC

We find that in practise the BOD and COD tests are often supplemented, and BOD is sometimes being replaced by, a Total Organic Carbon (TOC) test. This is because TOC is an instrumental method, as compared with BOD which relies on bacterial activity, making it more reproducible and quicker to deliver as a test.

An example taken from the data from an Interlaboratory Comparison Programme (ILCP) is shown in the table below. The table shows that the COD testing is much more precise science than BOD testing. Note that there is not yet sufficient data on TOC ILCP to draw any firm conclusions.

BOD5	**Sample A [Meat effluent]**	**Sample B [Municipal effluent]**
# Labs	28	28
Mean	472	4.62
Std Dev	91	3.75
CV	19	81
COD		
# Labs	23	23
Mean	2043	22.0
Std Dev	157	8.7
CV	8	40
T.OC (Example only as few labs do this yet)		
# Labs	2	2
Mean	624	6.0
Std Dev	23	1.7
CV `	4	28

Bacteria and the need to 'seed' tests

Bacteria may be present in the sample naturally or are often 'seeded' into the test bottle by the addition of diluted secondary treated effluent or similar. Seeding is done to ensure there are sufficient numbers of bacteria to digest the organic matter during the test period.

Note that BOD tests carried out using seeds may give different results to tests using a bacterial source from the same site as the sample. This will be because the sample site bacteria will be habituated to the chemicals in the sample and may have developed site-specific distributions of different bacteria which selectively use the chemicals present.

Toxicity

Bacterial action may be affected by the sample matrix (Toxicity) and this must be overcome by pre-treatment or dilution of the sample to reduce the toxic effect.

It is for this reason that it is essential that the laboratory is informed if it is known that any of these following factors are likely to influence the samples

- extremes of pH
- sulphides eg from tanneries, paper plants, mining areas
- heavy metals eg from plating waste input
- chlorine from water treatment, etc
- peroxide (which may cause DO to increase not decrease)

The process we use to test for BOD

Our standard practice for samples of unknown origin, when we have no idea of probable levels of BOD, is as follows.

1. Samples are diluted with water and a nitrification inhibitor (ATU) added to each bottle, so this test gives results for CBOD5.
2. The pH of the sample is measured and adjusted to 6.5 - 7.5 if necessary.
3. A series of test bottles is set up with at least three different dilutions of the sample (eg relatively clean samples are diluted 1:2, 1:10, 1:50).
4. The sample is seeded using a municipal wastewater treatment plant (Hamilton) bacterial source, then saturated with air by shaking.
5. The dissolved oxygen level in each bottle is measured.
6. The samples are incubated (20±1°C, 5 days) and the DO measured again.
7. The CBOD5 is calculated and reported.
8. Immediately after the samples are first prepared, any remaining sample is frozen.
9. If a repeat analysis needs to be done from a frozen sample, it is seeded and ATU added to inhibit any NBOD from the seeding solution.
10. Repeat analyses are mainly carried out because of overdilution or insufficient dilution of the sample originally, but are sometimes required because of equipment failure (DO probe or incubator), because replicates or QCs are unacceptable, or because the sample contains a toxic factor.

Note If we carry out an analysis using a frozen sample this is always mentioned in the laboratory report.

Information in reports

Some laboratories simply report 'BOD' results. This often means CBOD5, and the laboratory should be requested to clarify whether an inhibitor was used and if the results are for CBOD5 or TBOD5 if this is not clear from the report.

References

1 Method 5210 B, 5-Day BOD Test, .Standard Methods for the Analysis of Water and Wastewater., 20th edition, APHA, 1998

2 US EPA Method 405.1, .Biochemical Oxygen Demand (5 days, 20°C). NB: for the method this refers to APHA!

3 National Water and Soil Conservation Organisation (NAWSCO), "Water and Soil Miscellaneous Publication No. 38", 1982

EXPANDING OUR RESIDUE TESTING CAPABILITY

WITH THE NEW API 4000™ LC/MS/MS SYSTEM

DUE TO INCREASING DEMAND FOR OUR RESIDUE TESTING SERVICES, HILL LABORATORIES HAS RECENTLY INVESTED IN ADVANCED ANALYTICAL INSTRUMENTATION.

A High Pressure Liquid Chromatograph and a highly sensitive Triple-quadrapole Mass Spectrometer was recently delivered to Hill Laboratories Food and Bioanalytical Division. This is the third of such instruments at Food and Bioanalytical and its purchase will allow Hill Laboratories to expand the range of residue tests, further reduce turn-around times, and significantly increase the sensitivity of many existing tests. For example, the new instrument will be utilised in the growing area of GLP pesticide and veterinary medicines testing.

The capability of our Food and Bioanalytical testing section is not limited to residue testing. This technology, along with highly specialised laboratory personnel with many years experience in the food and biological research fields, offers unique opportunity for low-level testing and compound identification for industry and research organisations.

CLEANING UP PAYS DIVIDENDS

THE APPLICATION OF THE "BIOTRAP" SYSTEM HAS PRODUCED AN EFFICIENT EXTRACTION AND CLEAN-UP PROCEDURE WHICH HAS BEEN ADDED TO HILL LABORATORIES SUITE OF TECHNOLOGIES.

The development of this technique has been prompted by the well documented issue of protein interference with a number of analytical techniques. The ability to remove virtually all protein from the matrix before analysis offers a cleaner sample to the analytical system resulting in a noticeable improvement in quality control parameters.

The method allows the selective extraction of a wide range of analytes with varying chemistries and the analytical results show excellent specificity, accuracy and precision.

The technique utilises robotic equipment for extraction, dilution and transfer to vial for a faster and more efficient and consistent preparation. The automation significantly reduces labour input allowing savings to be passed on to the customer.

The technique is particularly valuable in GLP studies where large numbers of samples can be involved, high precision is required and timeframes can be tight.

new faces at Hill Laboratories

AT HILL LABORATORIES WE RECENTLY APPOINTED A NUMBER OF NEW SENIOR PERSONNEL. THESE NEW MEMBERS OF STAFF WILL HELP US ENSURE THAT WE LISTEN TO YOU, UNDERSTAND YOUR EVOLVING NEEDS AND CONTINUE TO MEET THEM INTO THE FUTURE.

STEVE HOWSE
GENERAL MANAGER **Hill Laboratories**

Steve joined Hill Laboratories as General Manager in mid-2007. He is responsible for leading our NZ laboratory business, in support of Roger Hill who is focusing on international growth opportunities. Steve has an Honours degree in Agricultural Science, and prior to joining Hill Laboratories had a 15 year career at Livestock Improvement.

SEAN CLEARKIN
DIVISIONAL MANAGER **Environmental**

Sean Clearkin is the new manager of the Environmental Division. The Environmental Division offers soil, water and air testing focused on measuring organic and inorganic contaminants. He leads a team of over one hundred staff working on sample submission, analysis and result production.

MARTIN LOVELL
MARKETING MANAGER

Martin has ten years experience in sales and marketing in the UK, the US and more recently New Zealand. Martin will ensure that we focus on exceeding our customer expectations. He will help us realise the product developments that you would like to see delivered, and carry out any necessary marketing activities to fully inform you about our offerings

DAVID HARVARD
SECTION MANAGER **Organics**

David is the new 'Organics' section manager. His role encompasses managing three separate teams: the Solid Preparation Team where we grind soil samples to prepare for analysis, the Extraction Team handling the processes we use to prepare for instrument analysis and the Instruments Team, where the analysis of samples is actually carried out.

RAY LEWIS
DIVISIONAL MANAGER **Agricultural**

Ray is our new Agricultural Divisional Manager. The agricultural division offers soil plant and feed testing to customers working in the agricultural, horticultural and viticultural industries to name but a few. Ray manages a large team, responsible for delivery of a huge variety of tests geared to the primary sector.

CUSTOMER RESEARCH

iPod winners

In appreciation of your help and recognition of the time and effort needed to complete your questionnaire, all respondents went into a draw to win one of two Apple iPOD Nano's.

Congratulations to the lucky winners who received their prizes earlier this month.

winner1

BRETT OGILVIE
Senior Environmental Scientist
Tonkin & Taylor

Brett Ogilvie is a Senior Environmental Scientist with Tonkin & Taylor, and has 20 years postgraduate experience in environmental consulting and research. Brett holds postgraduate qualifications in freshwater and marine biology, and now works in the fields of ecology, environmental impact assessment, and catchment and coastal zone management.

winner2

CAROLIEN UDEMA
Technical Sales Representative,
Ballance Agri-Nutrients
Hauraki Plains/Coromandel

Carolien Udema joined Ballance in January 2006, having completed three years at Massey University studying for a Bachelor of Applied Science (Agriculture).

Carolien particularly enjoys the soil science and animal health aspects of agriculture, but she says the real bonus is the friendly, down-to-earth people so common to the farming world.