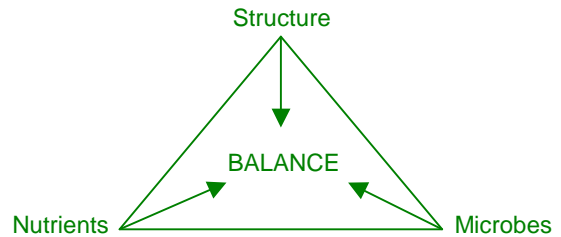


Organic Soil Audit Analysis



Sustainable Soil Management with the Mikhail Balance System

FILE NO : EXAMPLE

CLIENT NAME
ADDRESS 1
ADDRESS 2

SAMPLE ID : SAMPLE 1

DEPTH OF SAMPLE (cm): 0 to 10

DATE ISSUED : 1/08/2008

DATE RECEIVED : 1/05/2004

CLIENT ID :

PHONE :

REFERENCE : AGENT NAME

REFERENCE PHONE : AGENT PH. #

LAND USE! 1: PASTURE

2: LUCERNE

3: POTATO

ANALYSIS REQUIRED : Organic soil

CONTENTS:

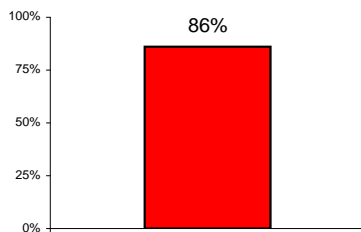
	<i>page</i>
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LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

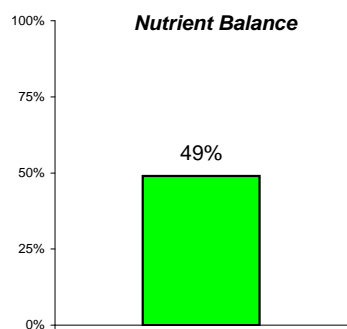
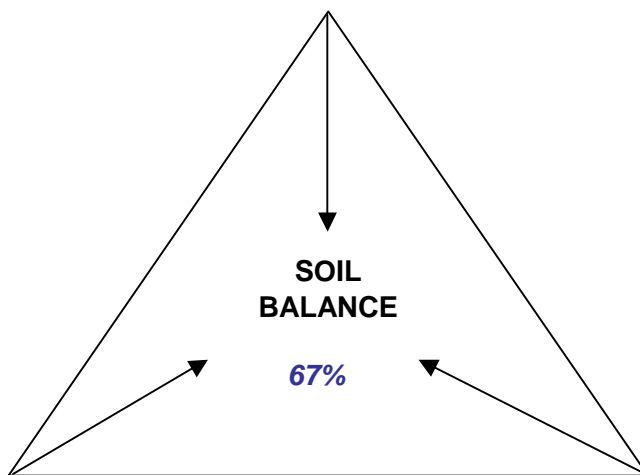
Summary of Complete Soil Balance Status

as at 1/05/2004

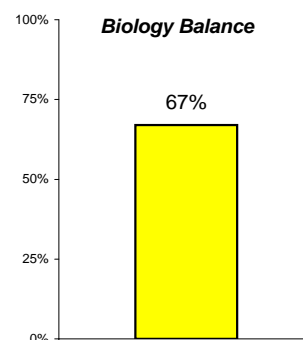
(Changes over time will indicate likely sustainability of production)



Cation Balance



Nutrient Balance



Biology Balance

Overall Soil Balance Rating				
Poor	Below average	Average	Above average	Good
<20%	20%-40%	40%-50%	60%-80%	>80%

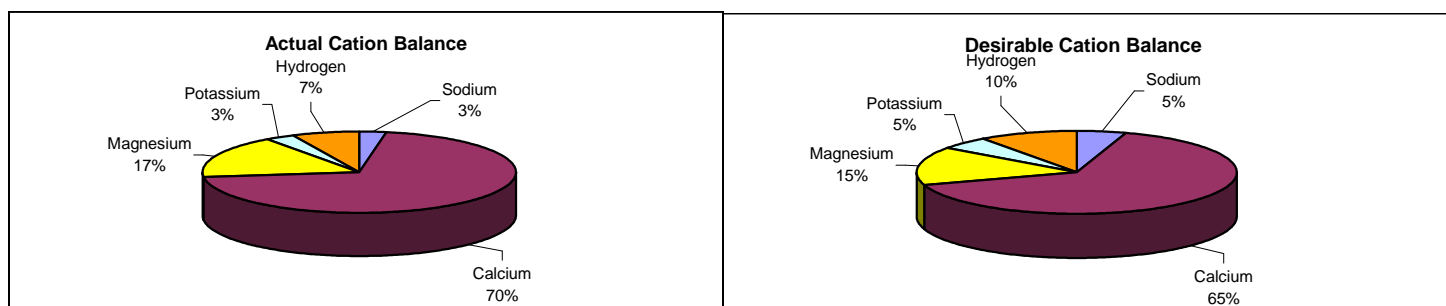
LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

Cation Balance

ITEM	RESULT	DESIRABLE	
pH(1:5 Water)	6.7	6.5-7.5	COLOUR : GREYISH BROWN
pH(1:5 0.01M CaCl ₂)	6.2		TEXTURE : FINE SANDY CLAY LOAM
Electrical Conductivity EC μS/cm	184	< 300	
TOTAL SOLUBLE SALT TSS ppm	607.2	< 990	
TOTAL ORGANIC MATTER %	5.7	6 - 10	
TOTAL ORGANIC CARBON %	2.9	3 - 5	

EXCHANGEABLE CATIONS			RESULTS	DESIRABLE LEVEL
CALCIUM	Ca	me/100 of soil	10.85	10.07
MAGNESIUM	Mg	me/100 of soil	1.66	2.32
SODIUM	Na	me/100 of soil	0.3	< 0.77
POTASSIUM	K	me/100 of soil	1.13	0.77
HYDROGEN	H	me/100 of soil	4.4	
ADJ. EXCH. HYDROGEN	H	me/100 of soil	1.65	< 2.32
CATION EXCHANGE CAPACITY	CEC		18.34	
ADJUSTED CEC	Adj.CEC		15.49	
SATURATION BASE PERCENTAGE	BSP		78	

EXCHANGEABLE CATION BALANCE		% OF ADJUSTED CEC	DESIRABLE
CALCIUM PERCENTAGE		70.0	65-70%
MAGNESIUM PERCENTAGE		10.7	12-15%
SODIUM PERCENTAGE	ESP	1.9	0.5-5%
POTASSIUM PERCENTAGE		7.3	3-5%
ADJ. HYDROGEN PERCENTAGE		10.0	<20%
CALCIUM / MAGNESIUM RATIO	Ca/Mg	6.53	2 - 4



CATION BALANCE CORRECTIONS

(To optimise the soil structure & condition)

GYPSUM REQUIREMENT	0 t/ha	
LIME REQUIREMENT	0 t/ha	
DOLOMITE REQUIREMENT	0 t/ha	
MAGNESIUM SULPHATE	25 kg/ha	or MAGNESIUM OXIDE 14 kg/ha

LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

NOTES ON CORRECTING THE EXCHANGEABLE CATION BALANCE

The recommendations on page 3 are essential to the process of achieving optimum soil balance. All other recommendations in this report have been formulated on the assumption that they have been applied and given sufficient time for their effects to develop. In most cases, six months will be required between application of cation balance correction and fertilisers, however, more time may be required in lower rainfall zones or dry seasons. In areas with shallow saline watertables and NO subsurface drainage, no Gypsum should be applied (even if recommended here) until adequate drainage can be provided. It should also be noted that the amounts recommended depend, in part, on the stated sample depth.

The notes, below, provide additional information relating to the applications recommended. If you require more information on any aspect of these recommendations, please contact: **SWEP on (03) 9701 6007.**

For all required materials (where surface application is necessary and irrigation is not available), the total application should be limited to roughly 2.5 t/ha per year. This limitation does not apply where materials can be cultivated or irrigated into the soil.

Gypsum is recommended in order to replace any excess of exchangeable Sodium or Magnesium with exchangeable Calcium. For best results, use only 'A-grade' Gypsum.

LAND USES:	1	2	3
		PASTURE	LUCERNE

Nutrient Balance

ITEMS			RESULTS	DESIRABLE LEVEL		
				PASTURE	LUCERNE	POTATO
AVAILABLE CALCIUM	Ca	ppm	2416	2322	2322	2322
AVAILABLE MAGNESIUM	Mg	ppm	222	307	307	307
AVAILABLE SODIUM	Na	ppm	75.9	< 196	< 196	< 196
AVAILABLE NITROGEN	N	ppm	12	25	15	180
AVAILABLE PHOSPHORUS	P	ppm	125.8	30	45	200
AVAILABLE POTASSIUM	K	ppm	491.4	215	323	215
AVAILABLE SULPHUR	S	ppm	1.2	7	7	5
AVAILABLE COPPER	Cu	ppm	4.1	2	3	3
AVAILABLE ZINC	Zn	ppm	39.4	7	5.7	5.7
AVAILABLE IRON	Fe	ppm	28	> 20	> 20	> 20
AVAILABLE MANGANESE	Mn	ppm	18	> 20	> 20	> 20
AVAILABLE COBALT	Co	ppm	0.3	=>1.0	=>1.0	=>1.0
AVAILABLE MOLYBDENUM	Mo	ppm	0.7	1.0	1.0	1.0
AVAILABLE BORON	B	ppm	0.8	0.6	1.0	1.0
TOTAL PHOSPHORUS	TP	ppm	2191			
TOTAL NITROGEN	N	%	0.36			

Notes: - Phosphorus fixation may occur if Iron is more than 300 ppm
 - Manganese will reach toxic levels at 500 ppm or more

PLANT NUTRITION REQUIREMENTS

(For the specified Land Uses over the period of its growing season)

Land Use 1 PASTURE

TOTAL NUTRIENT REQUIREMENT (kg/ha)		N	P	K	S
		13	0	0	23
WITH	COPPER	0.5 kg	IRON		0 kg
	ZINC	0 kg	MANGANESE		3 kg
	COBALT	0.03 kg	BORON		0 kg
	MOLYBDENUM	0.03 kg			

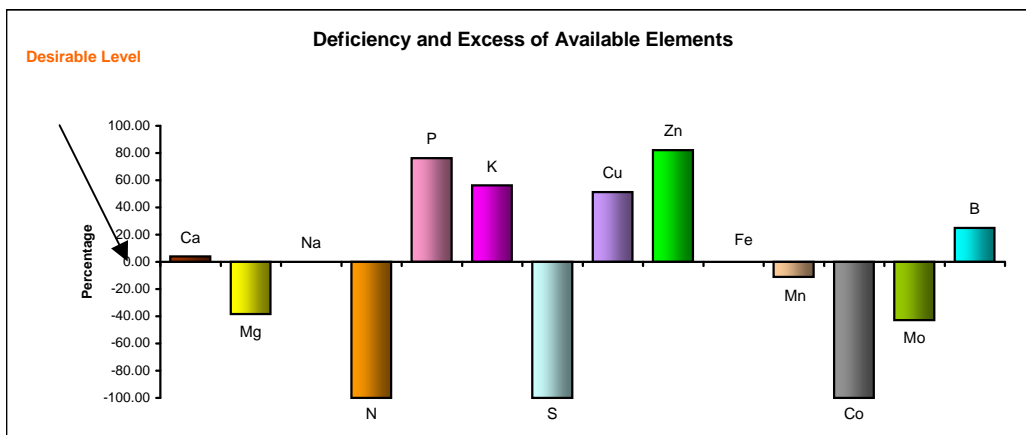
Land Use 2 LUCERNE

TOTAL NUTRIENT REQUIREMENT (kg/ha)		N	P	K	S
		5	0	0	23
WITH	COPPER	0 kg	IRON		0 kg
	ZINC	0 kg	MANGANESE		3 kg
	COBALT	0.03 kg	BORON		0.75 kg
	MOLYBDENUM	0.03 kg			

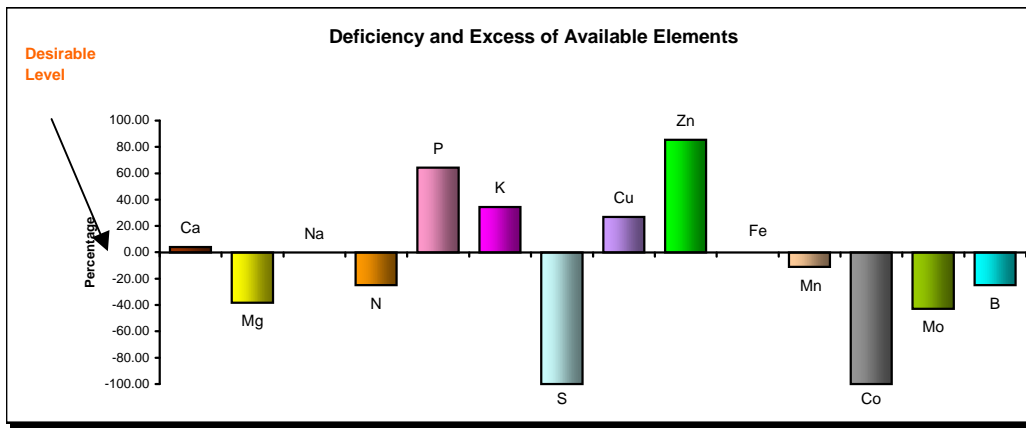
Land Use 3 POTATO

TOTAL NUTRIENT REQUIREMENT (kg/ha)		N	P	K	S
		168	74	0	23
WITH	COPPER	0 kg	IRON		0 kg
	ZINC	0 kg	MANGANESE		3 kg
	COBALT	0.03 kg	BORON		0.75 kg
	MOLYBDENUM	0.03 kg			

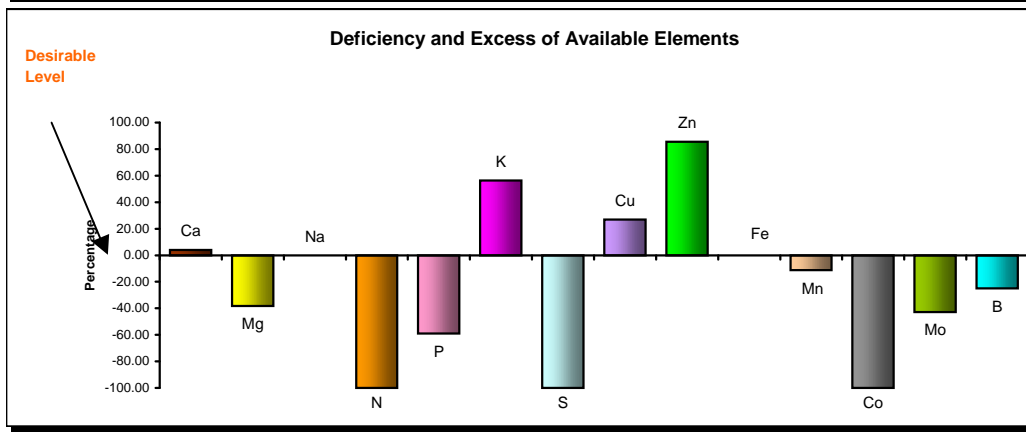
Land Use 1 PASTURE



Land Use 2 LUCERNE



Land Use 3 POTATO



NOTES ON ACHIEVING BALANCED PLANT NUTRITION

SWEP does not recommend or promote specific products. All recommendations are given in kg/ha of actual nutrient. These must be converted into applications of fertiliser. For assistance in doing this, consult your local supplier.

Important: Do not apply fertiliser at the same time as Lime, Dolomite or Gypsum.

For soils with a pH (water) of 8.0 or more, apply Trace Elements as a foliar spray only.

NB. Additional notes that pertain to specific Land uses are provided (where applicable) on Page 10 of this report.

If you require more information on any aspect of these recommendations, please **contact SWEP on (03) 9701 6007.**

LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

ADDITIONAL PLANT NUTRITION NOTES FOR SPECIFIC LAND USES

For Pasture, it is important to maintain the proper relationship between Copper (Cu) and Molybdenum (Mo). Where 'Moly' is required, you may see we have also recommended Cu, even though the soil test may not indicate Copper requirement. This will protect against the risk of any subsequent animal health problems. If you wish to avoid applying this Copper (when soil levels are adequate), you must ensure at least 6 weeks between the application of Molybdenum and the re-introduction of livestock.

LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

UNDERSTANDING SOIL BIOLOGY

Indicators of Soil Biological Activity

The biological community in the soil is extremely diverse. To get a proper understanding of its 'health' we look at a few so-called "Indicator" groups. These have important functions upon which plants and other organisms depend.

The first thing to remember is that SWEP results are for ACTIVE micro-organisms only. This means only those that will immediately grow under ideal conditions (generally about 7-10% of total soil biomass). This allows us to analyse samples year round, since the microbes that are active in spring will still be present in summer or winter, but at very reduced levels of activity. Given the ideal conditions in our cultures, they will spring back to life and grow much more quickly than others.

Also in assessing the results from your test, bear in mind that the soil is a complex ecosystem, but ecosystems are more than just biological communities, they are the product of environmental factors, available resources AND biology, disturbance in one or more of these areas will effect what happens in the biological community. The greater the disturbance, the more potentially variable the results, with higher total populations, dominated by one or two groups.

Active Indicator Organisms

Photosynthetic bacteria like *Rhodospseudomonas spp* and *Bradyrhizobium spp* require only sunlight, carbon dioxide and mineral nutrients to survive. They are important in recycling organic matter, particularly compounds that are difficult to break down - such as pesticide and petrochemical residues. They are also important for synthesis of bio-active compounds that are known to stimulate plant growth.

Yeasts such as *Saccaromyces spp*, *Debaryomyces spp*, *Torulopsis spp* and *Rhodotrula spp* synthesise plant growth substances from amino acids and sugars that are produced by photosynthetic bacteria. These substances also promote the growth of Lactic acid bacteria and Actinomycetes.

Lactic acid bacteria such as *Lactobaccillus spp*, *Leuconostoc spp*, *Lactococcus spp* and *Pediococcus spp* produce Lactic Acid from sugars and carbohydrates. Lactic acid is a strong bio-suppressive compound that helps control harmful micro-organisms. This effect, together with other trace nutrients produced by members of this group, is particularly beneficial to the growth of Photosynthetic bacteria and Yeasts.

Actinomycetes such as *Actinomyces spp* and *Streptomyces spp* produce antibiotic compounds that are effective suppressants of pathogenic organisms. They have also been shown to produce plant hormones - especially when treated with kelp extracts.

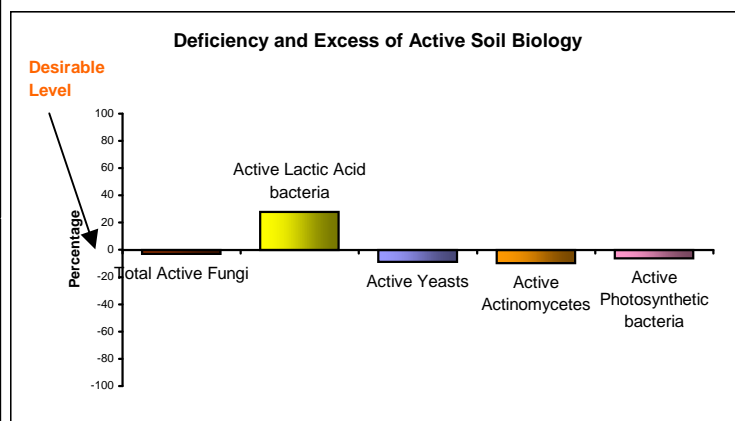
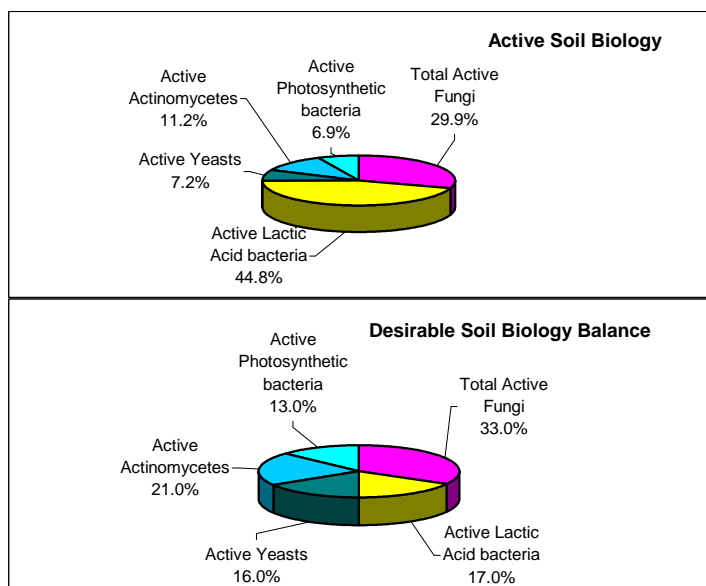
Fungi such as *Aspergillus spp*, *Penecillium spp*, *Mucor spp* and *Rhizopus spp* have many beneficial effects on plant growth. These include the production of enzymes, antibiotics and various growth regulators. They are also important in the conversion of organic matter to humic substances. Some of the less complex compounds produced from this process are also important food sources for some bacteria.

Cellulose Utilisers like *Trichoderma spp* require only minerals and cellulose for growth. These fungi break down plant remains into organic materials that are beneficial to other micro-organisms such as Protozoa.

LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

Biology Balance

ITEM	Result	% Total	Desirable	% Desirable	
ACTIVE LACTIC ACID BACTERIA	cells/g soil	175,000	23.1%	126,476	17.0%
Active Fungi	cells/g soil	210,000			
Cellulose utilisers	cells/g soil	160,000			
TOTAL ACTIVE FUNGI	cells/g soil	<u>370,000</u>	48.9%	245,505	33.0%
ACTIVE YEASTS	cells/g soil	80,000	10.6%	119,033	16.0%
ACTIVE ACTINOMYCETES	cells/g soil	1,250	0.2%	156,231	21.0%
ACTIVE PHOTOSYNTHETIC BACTERIA	cells/g soil	130,000	17.2%	96,714	13.0%
Total Active Population:	cells/g soil	756,250		743,956	
CARBON/NITROGEN RATIO		7.9		10-15	



SOIL BIOLOGY MANAGEMENT *(To help accelerate changes in soil structure and nutrient availability)*

Kelp extract	2 litres/ha	To encourage Actinomycetes, Photosynthetic &/or discourage Fungi
Molasses	0 litres/ha	
Worm leachate	0 litres/ha	
Fish emulsion	2 litres/ha	Helps improve the C:N ratio & discourages Lactic Acid Bacteria
Liquefied humate	0 litres/ha	
Mulch or Green Manure		

NB. Use only good quality materials & for best results, apply twice annually.

LAND USES:	1	2	3
	PASTURE	LUCERNE	POTATO

NOTES ON IMPROVING SOIL BIOLOGY MANAGEMENT

The recommendations on page 8 are not intended to directly adjust the numbers of microbes in the soil, but rather to encourage the activity of particular groups in order to help accelerate cation balance changes and optimise nutrient availability.

The notes, below, provide additional information relating to the applications recommended. If you require more information on any aspect of these recommendations, please contact: **SWEP on (03) 9701 6007.**

Kelp extracts contain high concentrations of plant hormones (auxins, cytokinins, etc.). These have been shown to significantly increase the biological activity in soils, and especially that of Actinomycetes and Cellulose utilisers. Cellulose utilisers (as the name suggests) are important in the breakdown of cellulose and certain other resistant materials, thus increasing the formation of humus and helping to improve soil structure. Actinomycetes also help provide protection against soil-borne pathogens.

Molasses provides a readily metabolisable carbon and energy source for soil organisms. Although most soil organisms can utilise this, it is of particular value to fermenters like Yeasts and Lactic Acid Bacteria. However, being quickly utilised, it will provide only a short-term benefit unless other actions have been taken to improve the soil environment.

Worm leachate contains a range of growth promotants that are of particular benefit to Photosynthetic Bacteria and Actinomycetes. Photosynthetic bacteria are of particular importance in the breakdown of highly resistant organic compounds (including some pesticides). They can exist to some depth in soil as they utilise different wavelengths of light to green plants. It is this energy source that allows them to perform their vital role in the soil.

Fish emulsions are a source of readily available organic Nitrogen and can be especially useful when this is needed to improve the carbon-nitrogen ratio in the soil. They are also beneficial in stimulating growth and activity of many micro-organisms, but especially Yeasts and Bacteria. The net effect is an increase the potential for nitrogen cycling and so also a somewhat reduced requirement for nitrogen inputs to some crops and pasture. For this potential to be realised, however, other corrective measures must be applied first.

You should also be aware that some fish emulsion products contain other added nutrients to render them appropriate for use as conventional fertilisers and that the concentration of products can vary significantly. For best results with these products talk to your supplier about any adjustments to our recommended application rates and/or changes to your nutrient applications that may be appropriate.

Liquefied humate adds carbon to the soil in the form of humic substances. It is a useful material where adjustment of the carbon-nitrogen ratio is required. It is also important in releasing bound nutrients into plant available forms and helping to improve soil structure. The direct effects on soil biology are similar to those of Kelp extracts in that many humic substances appear to have an auxin-like activity. Like Fish Emulsions, concentration and inclusion of added nutrients may need to be taken into account for specific products.

Mulching or Green Manuring is an effective means of improving organic matter levels and protecting soil structure in cultivated soils. The breakdown of this material is initially conducted by soil Fungi (especially in clay soils). For pasture, alternatives include regular light harrowing (after grazing) and adjustments to normal grazing practices, etc.

LAND USES:	1	2	3
		PASTURE	LUCERNE

SOIL CONTAMINANT AUDIT

TOTAL HEAVY METALS:

		Result	Limit for Organic Production *
Copper	Cu	6.67	50 ppm
Zinc	Zn	57.9	150 ppm
Cadmium	Cd	0	2 ppm
Lead	Pb	4.25	100 ppm
Mercury	Hg	0.012	1 ppm
Chromium	Cr	8.96	150 ppm
Nickel	Ni	3.34	50 ppm
Arsenic	As	2.3	10 ppm

* The lowest of either NASAA or ACO standards.

* CONTAMINANT PESTICIDES

ORGANO-CHLORINE PESTICIDES:

Result (ppm)		Result (ppm)	
alpha-BHC	n/d	Dieldrin	n/d
Hexachlorobenzene	n/d	4,4-DDE	n/d
beta-BHC	n/d	Endrin	n/d
γ-BHC (Lindane)	n/d	beta-endosulphan	n/d
delta-BHC	n/d	4,4-DDD	n/d
Heptachlor	n/d	Endrin aldehyde	n/d
Aldrin	n/d	Endosulphan sulphate	n/d
Heptachlor epoxide	n/d	4,4-DDT	n/d
trans-chlordane	n/d	Endrin ketone	n/d
alpha-endosulphan	n/d	Methoxychlor	n/d
cis-chlordane	n/d		

n/d = not detected

ORGANO-PHOSPHATE PESTICIDES:

Result (ppm)		Result (ppm)	
Dichlorvos	n/d	Parathion	n/d
Demeton-S-methyl	n/d	Pirimphos ethyl	n/d
Monocrotophos	n/d	Chlorfenvinphos	n/d
Dimethoate	n/d	Bromophos ethyl	n/d
Diazinon	n/d	Fenamiphos	n/d
Chlorpyrifos methyl	n/d	Prothiofos	n/d
Parathion methyl	n/d	Ethion	n/d
Malathion	n/d	Carbophenothion	n/d
Fenthion	n/d	Azinphos methyl	n/d
Chlorpyrifos	n/d		

n/d = not detected

- Compounds tested are those included in the USEPA 8270 analyte list.
- Composts and Manures should show no detectable levels of any pesticide compound.
- The Organic Soil Maximum is an indicator only, set at 10% of the lowest FSANZ Australian MRL. Refer to your auditor for further details and tissue test follow up in the event of a detection.
- Some MRLs are defined as the sum of two or more compounds. Here the same standard is applied to each of the component compounds.
- Where no Human Food MRL is set, Animal Feedstuff MRLs are applied.
- Where no MRL is defined at all, the Organic Soil Maximum level has been set as "nil".
- All results are given on a 'dry weight' basis.

* Organo-chloride and Organo-phosphate pesticides have been tested by ALS Laboratory Group
work order: EM0805490

