Improving Soil Management on Hunter Valley Dairy Farms

During 2010-2011, 20 dairy farms from the Hunter Valley participated in a program aimed at improving soil management on their properties. The farmers undertook training and conducted an extensive soil testing program to develop a detailed understanding of their soils and how management could be improved.

The soil testing program involved analysing both top soil (0 to 10cm) and sub soil (10 to 20cm) samples from over 200 paddocks across the Hunter.

The summary of results presented here provides an overview of soil (nutrient) fertility on dairy farms across the Hunter. It should be noted that while most samples come from typical dairy grazing paddocks most farms included samples from effluent disposal areas or other paddocks which were unusual in some way to give a broad range of conditions on different areas of the farm.

This summary provides an interesting overview however individual paddock testing is needed to help make fertiliser management decisions on the farm.

Soil pH ($CaCl_2$)

< 4.6 Very acid. Needs lime to prevent sub-soil acidity developing (check sub soil test results), improve soil health and response from other fertilisers used. Growth of all pasture species would benefit from use of lime. Rate of lime depends on soil type.

4.6 – 5.2 Acid. Lime use is desirable. Check aluminium saturation % to decide if lime is essential for the crop or pasture being grown.

5.2– 6.7 Slightly acid. Aluminium toxicity not a problem with pH above 5.2 Most pastures will grow well with this pH.

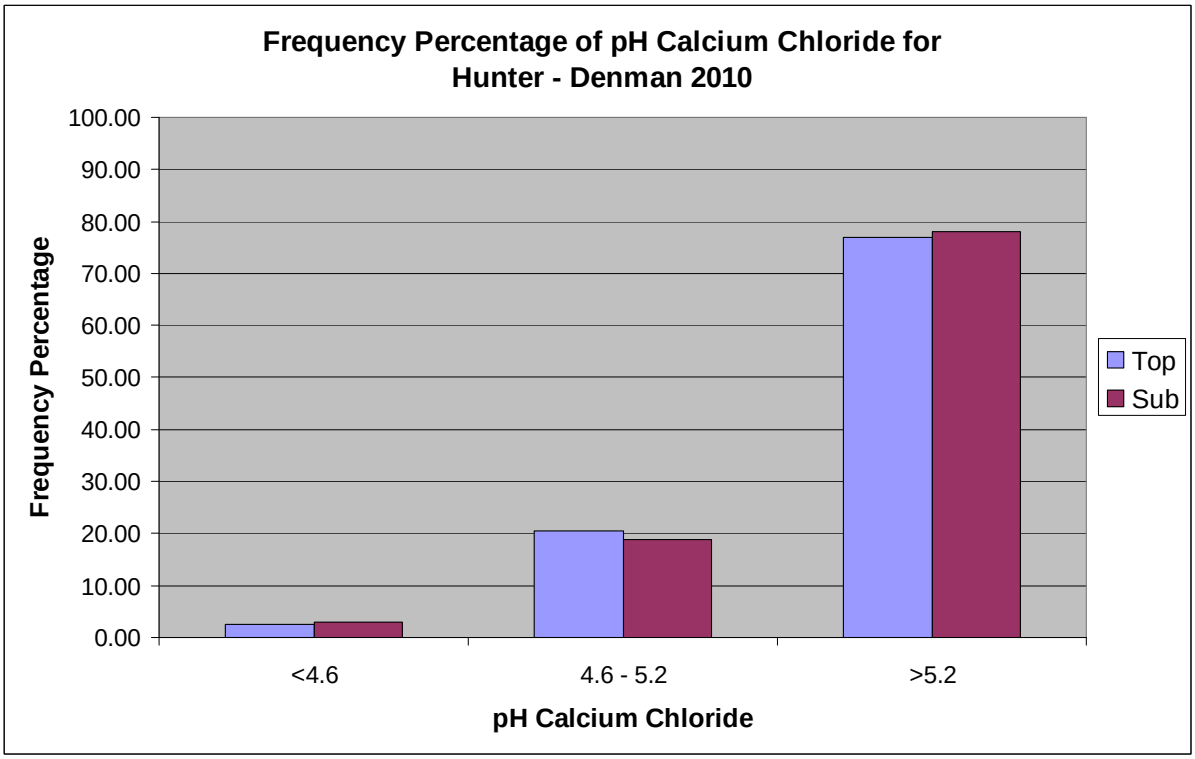
6.8 – 7.2 Neutral. Ideal pH for most crop and pasture species, ideal for soil health and efficient response from fertilisers used.

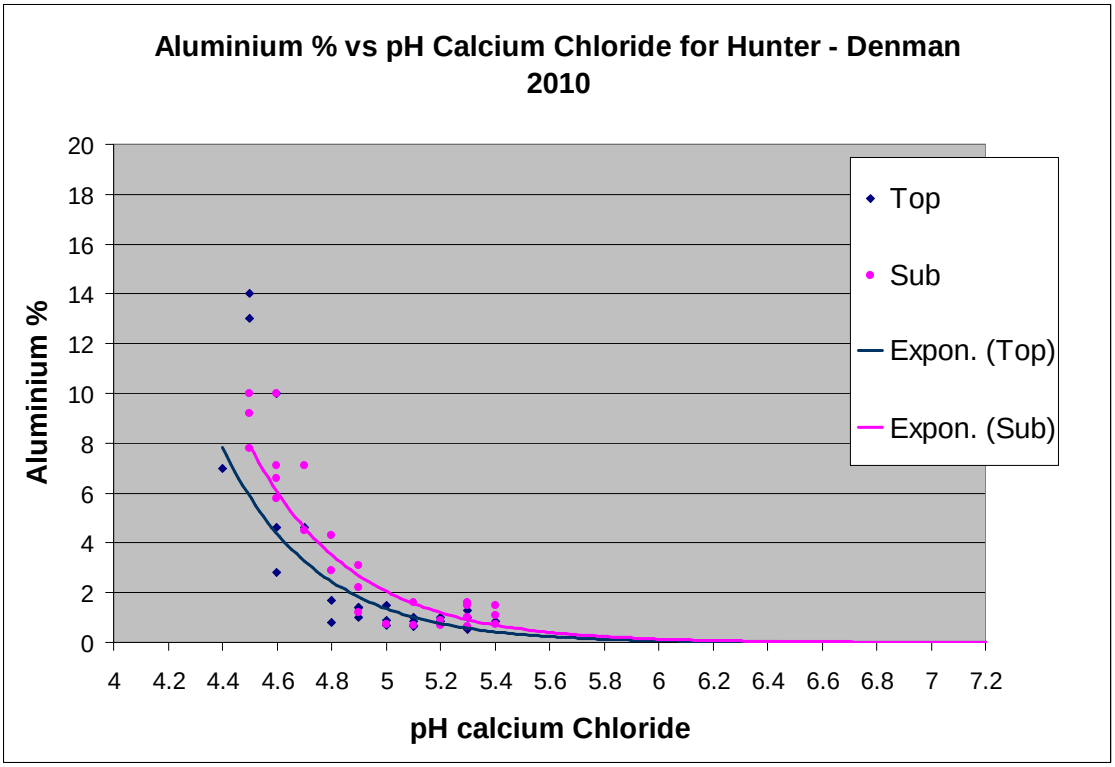
> 7.2 Alkaline. As pH rises above pH 7.5 chemical reactions change and availability of some nutrients and trace elements (NB: zinc deficiency) may change.

This project was conducted for the Hunter Dairy Development Group with funding support from the Hunter Central Rivers CMA

Hunter Dairy Development Group Inc

Hunter - Central Rivers CMA CATCHMENT MANAGEMENT AUTHORITY


Frequency Percentage of pH Calcium Chloride for Hunter - Denman 2010
Frequency Percentage
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
<4.6
4.6 - 5.2
>5.2
pH Calcium Chloride
Top
Sub


Aluminium % vs pH Calcium Chloride for Hunter - Denman 2010
Aluminium %
20
18
16
14
12
10
8
6
4
2
0
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
7
7.2
pH calcium Chloride
Top
Sub
Expon. (Top)
Expon. (Sub)

Phosphorus Buffer Index (PBI)

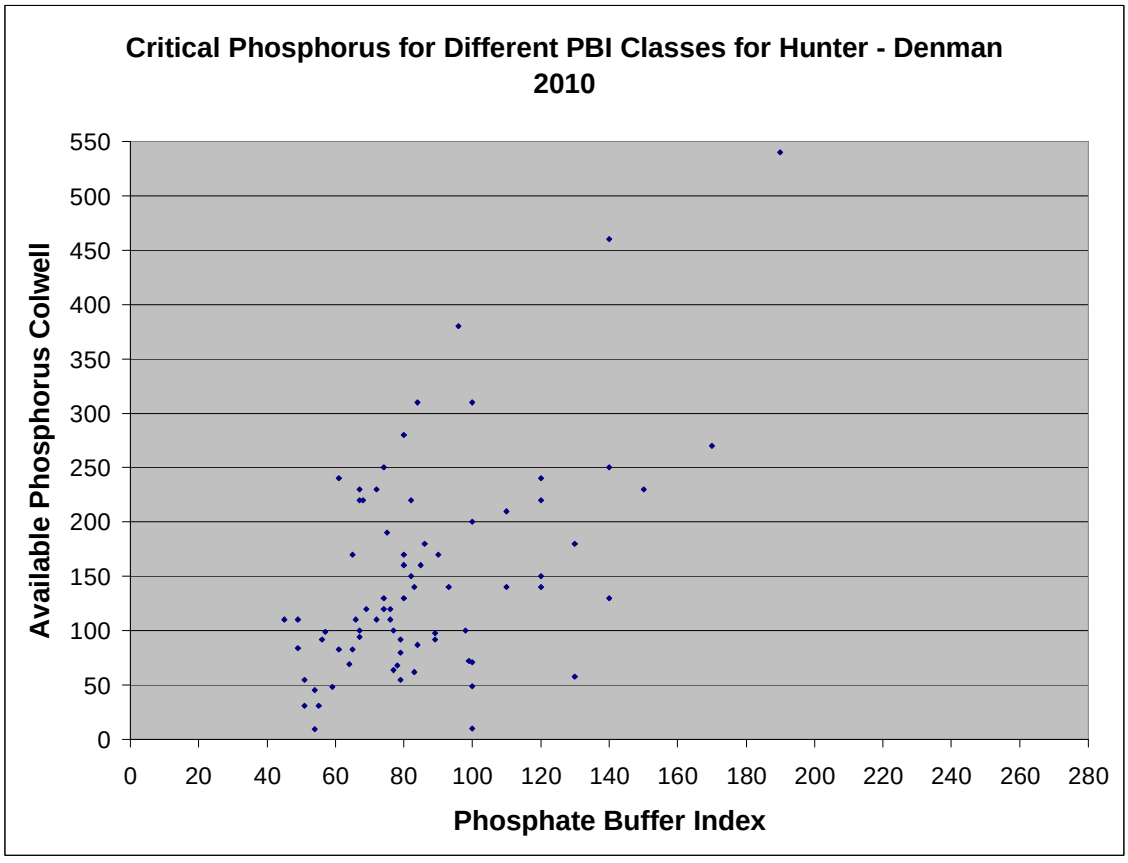
The PBI is used to add accuracy to the Colwell available phosphorus test rather than making management decisions based on PBI alone. Generally low PBI's are found on sandy soils, and higher PBI's on more clay soil, soil with very low pH and soils high in iron (eg red kraznozems /ferrosols such as Comboyne, Dorrigo.)

Low PBI indicates available phosphorus will change up or down readily. High PBI indicates the soil is more highly buffered and requires more phosphorus to be applied to see a change in plant growth.

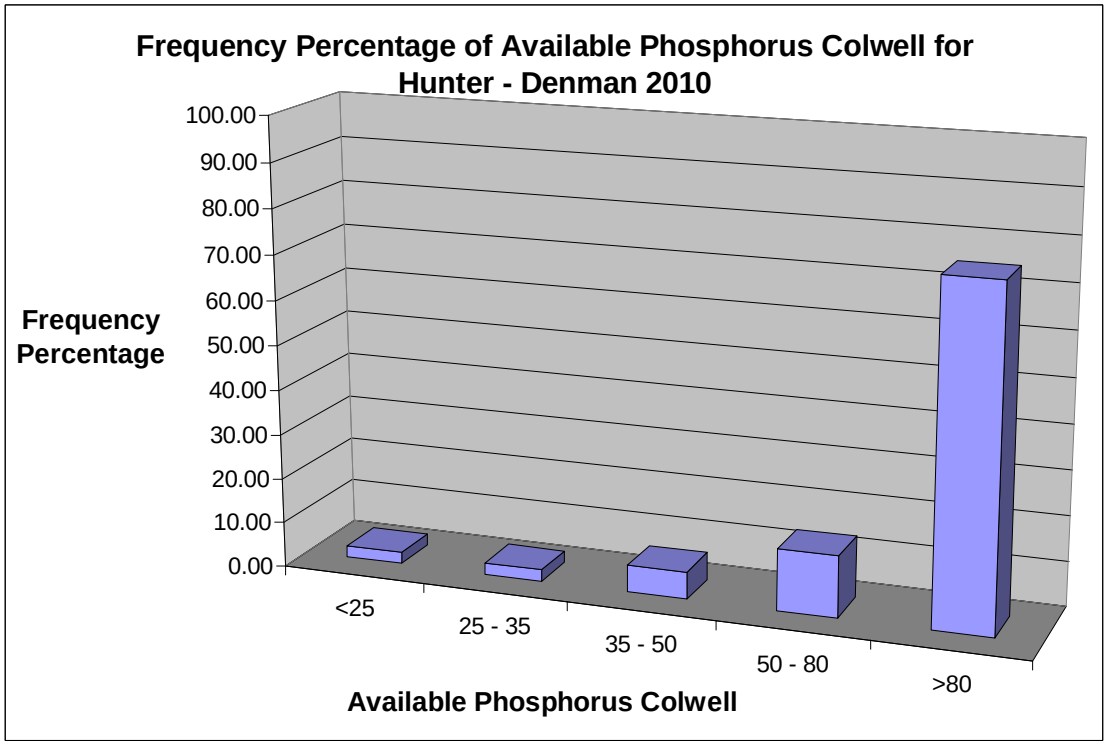
PBI Threshold	0-15	16-35	36-70	71-140	141-280	281-840	>840
	Colwell P (mg/kg)	Colwell P (mg/kg)	Colwell P (mg/kg)	Colwell P (mg/kg)	Colwell P (mg/kg)	Colwell P (mg/kg)	Colwell P (mg/kg)
Deficient	<15	<17	<19	<22	<26	<37	<50
Marginal	15-23	17-26	19-30	22-35	26-42	37-58	50-90
Adequate	24-30	27-34	31-39	36-45	43-54	59-75	91-120
High	31-41	35-47	40-53	46-61	55-74	76-102	121-150
Very High	>41	>47	>53	>61	>74	>102	>150

Available phosphorous (Colwell P)

As outlined above the PBI and Colwell tests are combined to assess phosphorous availability and likely response to applied fertiliser.

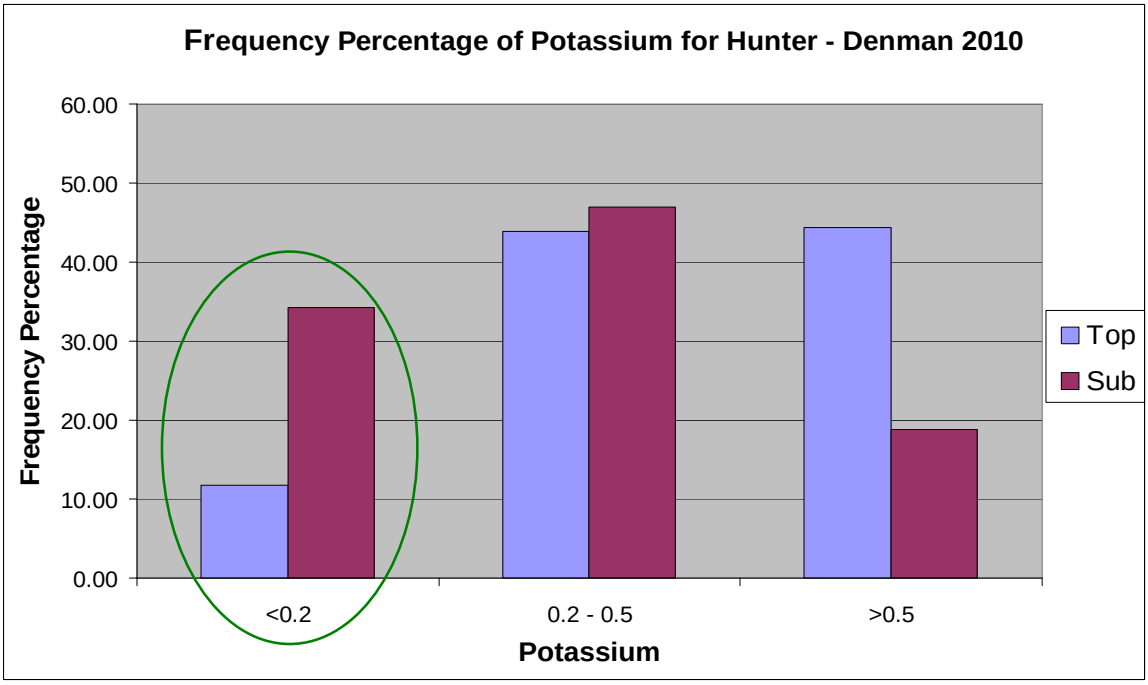


Deficient	Phosphorous deficiency is limiting growth of crops and pastures. Use of phosphorous fertilisers (in balance with other required nutrients) will increase pasture growth with associated improvements in ground cover and soil health
Marginal	Available phosphorous may be adequate for plants which are adapted to low P soils and generally have low growth rates. Marginal P soils will limit growth of highly productive crops and pastures grown on dairy farms. Aim to increase to adequate level. Phosphorous fertilisers are best applied when sowing pastures. Take care to ensure fertilisers stay where they are applied and do not wash into dams or waterways.
Adequate	Soil tests indicate available phosphorous is adequate to support most plant growth. Soils will need regular 'small' applications of phosphorous fertilisers to replace nutrients contained in farm produce and maintain soil fertility.
High	Soil phosphorous adequate to support all potential plant growth including on irrigated soils. Some phosphorous fertiliser applied when sowing new crops or pastures to encourage good initial establishment and growth should be adequate to maintain soil fertility.
Very High	Profitable response from applying phosphorous fertilisers to these soils is unlikely! Depending on level soil phosphorous may be maintained or can be allowed to decrease without harming soil health or potential pasture growth. Applying phosphorous fertiliser to these soils has increased risk of nutrient run off and possible water pollution



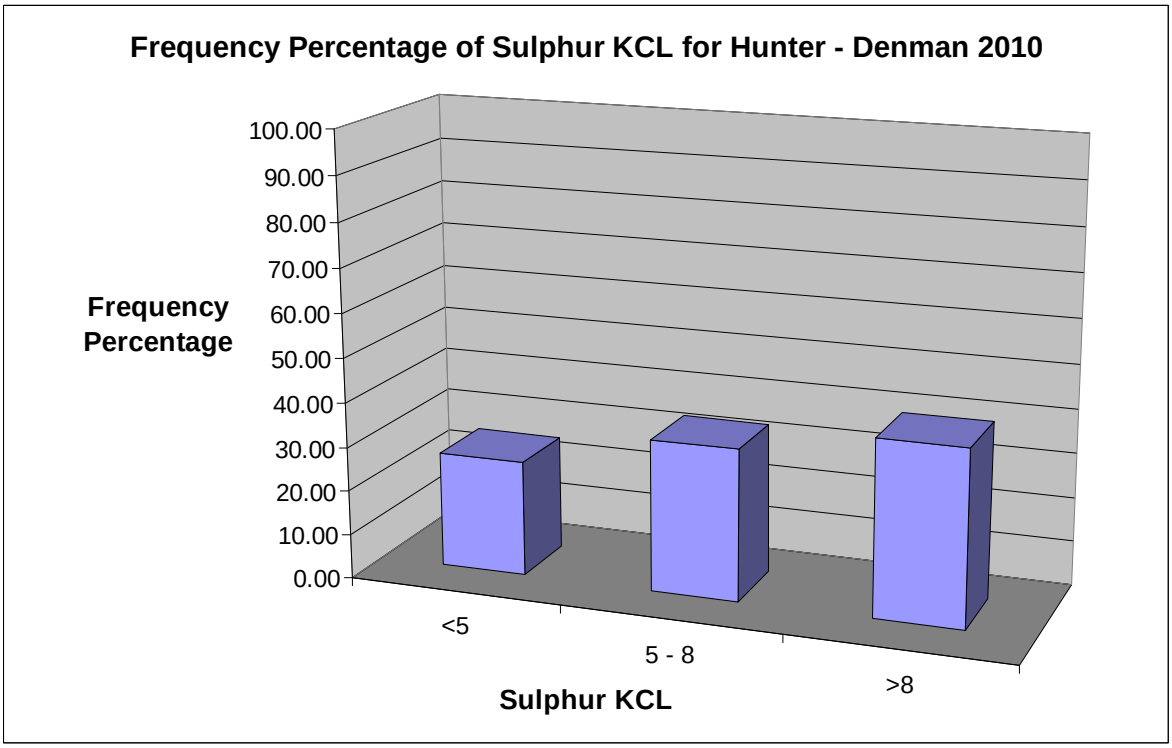
Potassium (K) (meq/ 100g)

<0.26	Deficient. Potassium is deficient which will limit pasture growth and persistence. Has implications for ground cover (erosion risk) and soil health. Legumes are most sensitive to potassium deficiency.
0.26 – 0.39	Marginal. May have adequate grass growth on low production dryland areas. Marginal potassium levels will limit growth and persistence of high production dairy crops and pastures. Potassium applied as dairy effluent, Muriate of Potash or Sulphate of Potash are common fertilisers used to build soil potassium levels. Apply as split applications several times per year especially after cutting silage or hay. Beware risk of grass tetany if applying large amounts of potassium in winter.
0.40 – 0.56	Adequate. Maintenance application of potassium fertilisers needed on high production areas to replace nutrients removed in farm produce.
0.57 – 0.72	High. Potassium levels adequate for plant growth. Look for signs of deficiency and monitor soil test results. May apply potassium fertiliser after harvesting silage or hay to maintain adequate K levels.
>0.72	Very High. Profitable response from potassium fertiliser unlikely. Monitor as part of regular soil testing.



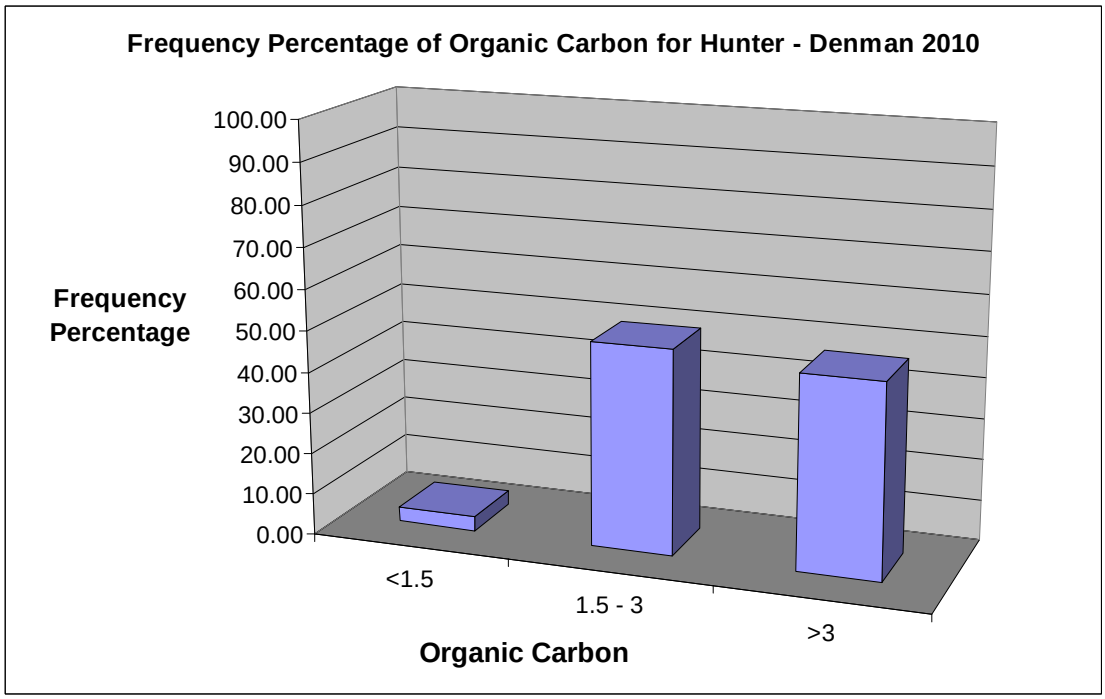
Sulphur (S) (KCl 40 method)

<5	Deficient. Sulphur deficiency will be limiting plant growth. Apply high sulphur fertilisers such as gypsum, elemental sulphur or sulphate of ammonia. The most suitable sulphur fertiliser or combination of fertilisers depends on soil type and other deficiencies which need to be addressed. Example gypsum if have dispersing clay soil or soil test indicated need for calcium as well as sulphur. Many fertilisers provide sulphur in combination with phosphorous, the use of ammonium sulphate (also called sulphate of ammonia) may be a preferred option where nitrogen is also needed but beware of increased soil acidification
5 – 8	Marginal. As Above. Marginal S levels will limit growth of dairy type pastures.
8 – 12	Adequate. Monitor and apply maintenance sulphur applications which may be in fertilisers used when sowing or top dressing.
12 – 18	High. Monitor and apply maintenance fertiliser if required.
>18	Very High. Applying extra sulphur not expected to increase crop or pasture growth.



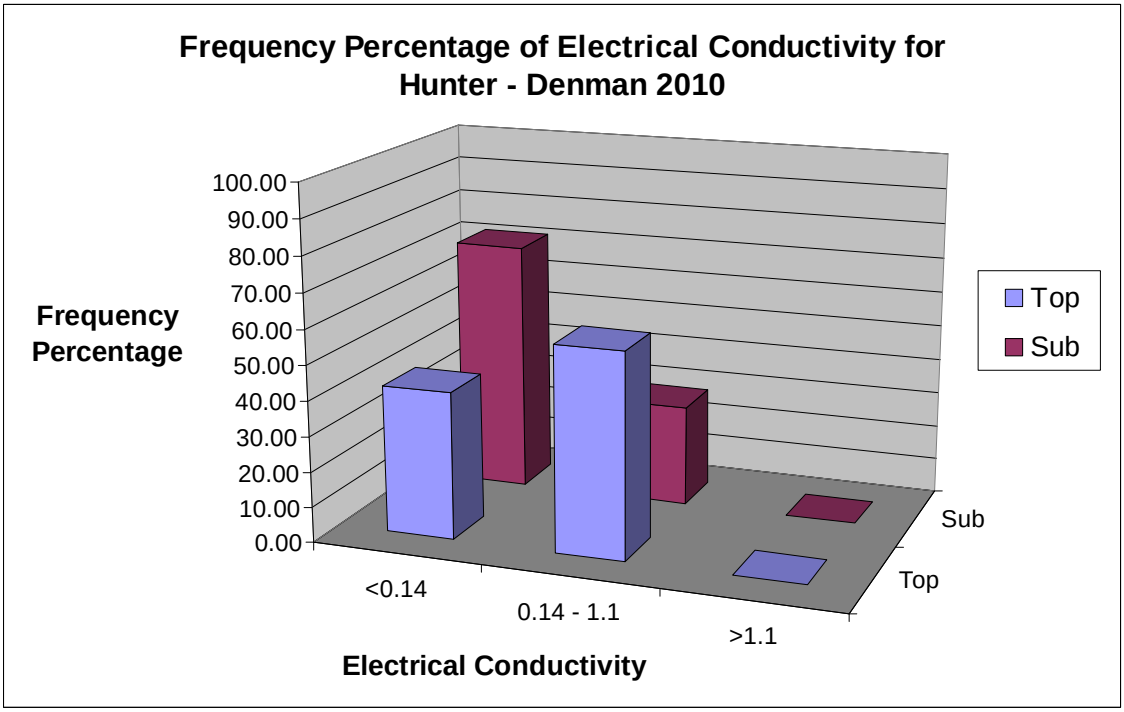
Organic Carbon % (Walkley & Black method)

Soil carbon occurs in many forms. Some feed microbes and encourage biological activity in the soil and some are more stable, improving soil structure, water holding capacity and nutrient availability. Generally permanent pasture soils have higher carbon % than soils which are cultivated.



Electrical Conductivity (Salinity) E.C.

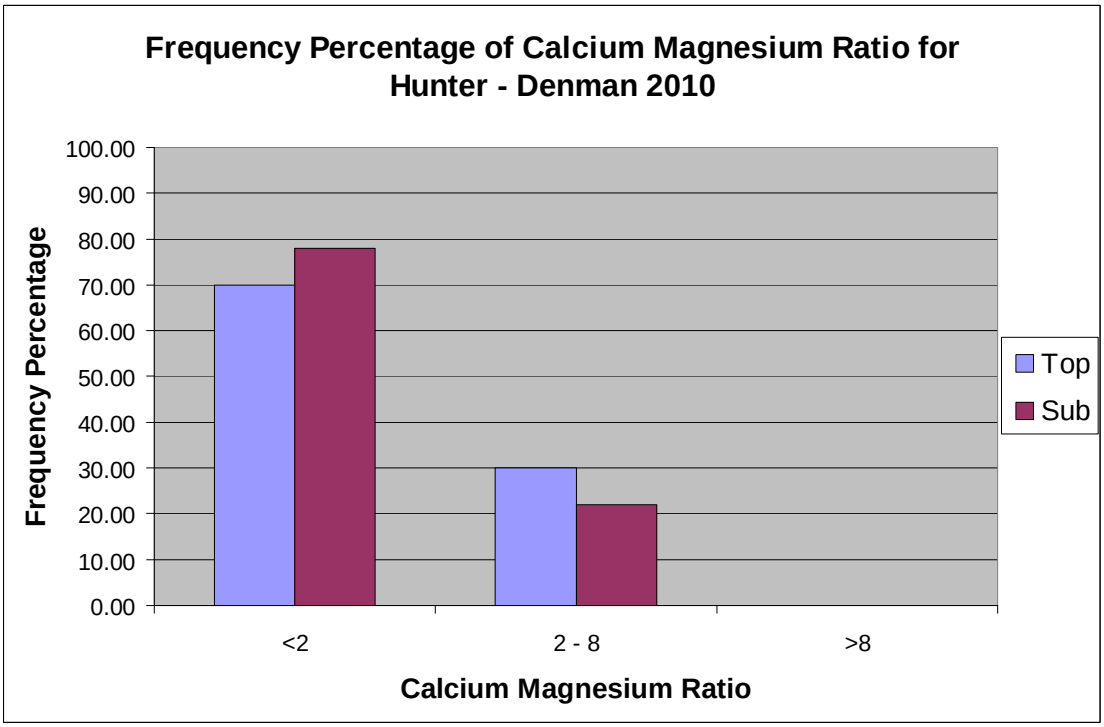
E.C. is used to measure salinity in soils. Results suggest that salinity is not limiting pasture growth on sampled soils but should continue to be monitored.



Calcium : Magnesium ratio (Ca : Mg)

Calcium : Magnesium ratio can be considered when making decisions to apply lime, dolomite, gypsum or potash.

Most soils had a low Ca :Mg ratio indicating that magnesium levels are relatively high.



Add soil health results

For further information contact Neil Griffiths, I&I NSW, Tocal on 4939 8948