# THE ANIMAL DIETARY MINERAL BALANCE REPORT – DAIRY COWS

*Hill Laboratories has developed a new report format for pasture and feed samples. This is called the* Animal Dietary Mineral Balance *report. It has been designed to assist Veterinarians and Consultants in their assessment of the mineral content of herbage, and how well it supplies the animal's daily requirements.*

A main feature is that this report considers the **animal requirements only**. This is in contrast to our standard Analysis Results histogram report, where the levels found are compared to optimum levels that are based on both plant and animal requirements, whichever is the greater. For example, an element such as potassium is graphed according to the plants requirements only, as the plant requires typically 2.5-3.5%, and the animal only 1.0%. Other elements, such as sodium and selenium, are assessed according to animal requirements, since they are not regarded as being essential for pasture growth.

## Instructions

This report requires some additional data from the farmer, namely animal species liveweight, calving date (if dairy) and the daily dry matter intake of the feed submitted. Enter ADMB in "other Tests" column of plant sample table. Add animal details in instructions section of request form. Two ADMB options are available per pasture sample e.g. beef and sheep. If the ADMB information is not provided, then the calculations assume a 400 kg animal, calving in mid-July. Daily dry matter intake is varied according to the time of year (See Table 1).

Another new feature of this report is that the minerals are shown as **Daily Intake** in grams and milligrams. If the daily dry matter intake is not provided by the client, then the following assumptions are made:

| Lactation Stage | Time of Year | Daily DM Intake |
|---|---|---|
| **Early Lactation** | July | 12 kg |
| **Peak Lactation** | August – November | 16 kg |
| **Late Lactation** | December – April | 12 kg |
| **Dry** | May – June | 8 kg |

**Table 1: Default values for New Zealand conditions.**

The **Daily Requirement** is also calculated, based on the animal's liveweight and the Lactation Period[1,2]. The difference between the actual daily intake and requirement is shown, and a bar graph provides a quick, visual guide as to the severity of any deficiency or surplus.

Presenting the results as Daily Intakes (g or mg) has three main advantages:

This is the best way to assess the animal's needs. Variable feed intakes makes the concentration in the feed approach less reliable. For example, the cow's daily selenium requirement is reasonably constant, irrespective of whether it consumes 8 kg or 12 kg of DM.

These units are "meaningful", in that the farmer or his advisor can readily calculate quantities of minerals required to further supplement the animal's diet. For example, if the report shows a deficit of 8 mg of copper per animal per day, it is simple arithmetic to convert this into quantities to incorporate into feeds, etc.

**Hamilton**
1 Clyde Street
Hamilton 3216
Private Bag 3205
Hamilton 3240
New Zealand
**T** +64 7 858 2000
**F** +64 7 858 2001

**Christchurch**
101c Waterloo Road
Hornby Christchurch 8042
PO Box 16607
Christchurch 8441
**T** +64 3 377 7176
**F** +64 3 377 7276

## Nutrient Interactions

The bar graph shows the difference between the animal's daily intake and requirement of minerals, each considered individually. However, mineral availability is often influenced by interactions between minerals. e.g. magnesium and/or calcium deficiencies often exist where there are adequate levels in the diet, but the potassium level is excessive.

The degree to which animals are affected by metabolic disorders such as milk fever, grass tetany, bloat is influenced by a number of factors including level of feeding (energy intake), mineral content of the diet (including interactions between minerals) and stress.

Calculation of the indices or ratios listed below is a useful guide to the effect if interactions between minerals.

**Grass Tetany Index (K/Ca+Mg) in meq)***

Potassium levels in pasture are normally high for grazing animals, however provided that the grass tetany index is below 2.2 this may not be a problem. At higher index levels, high potassium reduces the availability of calcium and/or magnesium so that grass tetany risk is increased, (hypomagnesaemia).

***[(K/39) / ((Ca/20) + (Mg/12.5))]**

**K/Na ratio—sometimes referred to as 'bloat index'**

High potassium is associated with low sodium levels in pasture, poor uptake of dietary sodium and increased incidence of bloat in grazing animals. Adequate sodium is required for animal health and productivity, particularly lactation of dairy cows.

**DCAD (Milk Fever) Index (K+Na) - (S+Cl) in meq/kgDM***

Dietary Cation Anion Difference is an approach to estimating the potential of a diet to be acidogenic (low index level) or alkalogenic (high index level). Milk fever incidence is associated with DCAD at high levels, risk increasing as levels are progressively higher than 200. Increasing the dietary sulphur + chloride levels and decreasing potassium + sodium levels is the standard approach to reducing DCAD through choice of dietary supplements such as magnesium or calcium (sulphate or chloride options).

***[(((K/39) + (Na/23)) - ((S/16) + (Cl/35.5))) x 10000]**

**Ca/P Ratio**

Calcium and phosphorus are known to interact: when the status of one is marginal or low, a high level of the other may have a significant effect. Pastures tend to be low in calcium, so high phosphorus levels giving a low Ca/P ratio are associated with milk fever incidence.

**Nutrient Ratios**

While there is no dispute that nutrient interactions have a very real effect on the availability of many nutrients, there has been some debate about the validity/reliability of some of the ratios to predict clinical metabolic disorders. Hill Laboratories acknowledge this, and have only calculated ratios that, in their opinion, have some validity and usefulness as risk indicators.

**Interpretation**

| | |
|---|---|
| Grass Staggers Index | <1.8 recommended; >2.2 increased risk |
| K/Na Ratio | <10 recommended; >20 increased risk |
| DCAD | <200 recommended; >200 increased risk |
| Ca/P Ratio | >1.5 recommended; <1.2 increased risk |

## Certain Feed Types are Naturally Low in Minerals

Some feeds are inherently low in minerals, and will therefore rate poorly in this new reporting format. Examples would be grain-based feed concentrates, and some of the high yielding bulk feeds being grown today (for example, maize silage, Sudax grass).

We would urge the farmer not to take this to mean these are inferior feeds. They are grown primarily as an energy supplement, being rich in carbohydrate, and as such, have an important role in achieving an overall balanced nutrition. This report will simply highlight they are feedstuffs low in minerals, and if they comprise a significant part of the animals intake, then careful attention needs to be paid to the other feed components, to ensure an adequate supply of minerals.

## The "Model" behind the Report

This new report is comprised of three separate calculations.

1. **Calculation of the Daily Mineral Intake** This is involves taking the results of the feed analysis (as concentrations in the feed), and multiplying them by the quantity of D.M. consumed daily. This gives the actual quantities (in g and mg) of nutrient being consumed. If D.M. Intake is not supplied, then quantities as shown in Table 1 are assumed
2. **Calculation of the Daily Requirement** This required establishing the mineral requirements by referencing a number of publications. These requirements are defined for three lactation stages (as shown in Table 1), and for a 400 kg cow. If the calving month is not July, then the requirements are adjusted, according to the calving date supplied. If an average cow liveweight is provided, then the requirements are again scaled proportionately to the default 400kg.
3. **Deriving the deficit/surplus** This is very straight-forward, simply being the difference between the daily intake and daily requirement. Slightly more complex is the construction of the bar graph, showing the severity of the imbalance. Differences of opinion abound in the literature, and Hill Laboratories have used their resources and experience to set these critical levels to the best of their ability

## Some Issues of Interest

**Selenium.** There is one school of thought that high producing dairy cows require higher levels of selenium than has been used in the past (ie. 0.30 mg/kg rather than 0.05 mg/kg in the feed.) Recently published NZ work[3] indicates the lower levels are mostly adequate.

Our interpretive scale is based on a feed content of 0.08 - 0.15 mg/kg for high-producing dairy cows, being a margin above the threshold of deficiency to allow for seasonal and analytical variation.

**Copper.** Perhaps the element of most interest with respect to nutrient interactions is copper, and it is unfortunate that there is no reliable calculation available to quantify the effects of interferences on this nutrient. It is well known that high levels of molybdenum, sulphur, iron and zinc can all reduce the dietary availability of this element.

## ADMB reports are available for:

| Classification | Liveweight | Information Required |
|---|---|---|
| Dairy Cows | 400 kg (milking season wt) | Calving Month, feed intake --kg dm/day, average liveweight during lactation |
| Beef Cattle | 300 kg | Average liveweight |
| Sheep<br>& Lambs | 60 kg<br>30 kg | Average liveweight |
| Dairy Goats | 60 kg | Average liveweight |
| Deer | 90 kg | Average liveweight |
| Horse | 500 kg | Average liveweight |

* Default values will be assigned if not already given

**Hamilton**
1 Clyde Street
Hamilton 3216
Private Bag 3205
Hamilton 3240
New Zealand
**T** +64 7 858 2000
**F** +64 7 858 2001

**Christchurch**
101c Waterloo Road
Hornby Christchurch 8042
PO Box 16607
Christchurch 8441
**T** +64 3 377 7176
**F** +64 3 377 7276

**Note**: For stock classes, except for dairy cows, it is assumed that animals are well fed on the diet as sampled in an active growth stage, or pregnant or lactating.

[1] Nutrient Requirements of Domestic Animals - Nutrient Requirements of Dairy Cattle. Sixth Revised Edition (1989 Update), National Research Council. National Academy of Sciences, Washington D.C. 1988.

[2] The Mineral Requirements of Grazing Ruminants. Ed. N.D. Grace. Occasional Publication No. 9, New Zealand Society of Animal Production 1983.

[3] Managing Trace Element Deficiencies. Grace, N. New Zealand Pastoral Agriculture Research Institute Ltd 1994

## Contact Details

For further information please contact our Agriculture client service managers.


| | |
|---|---|
| Fiona Calvert | fiona.calvert@hill-labs.co.nz |
| Janice Christiansen | janice.christiansen@hill-labs.co.nz |
| Nevan Ofsoski | nevan.ofsoski@hill-labs.co.nz |
| Jane Smillie | jane.smillie@hill-labs.co.nz |