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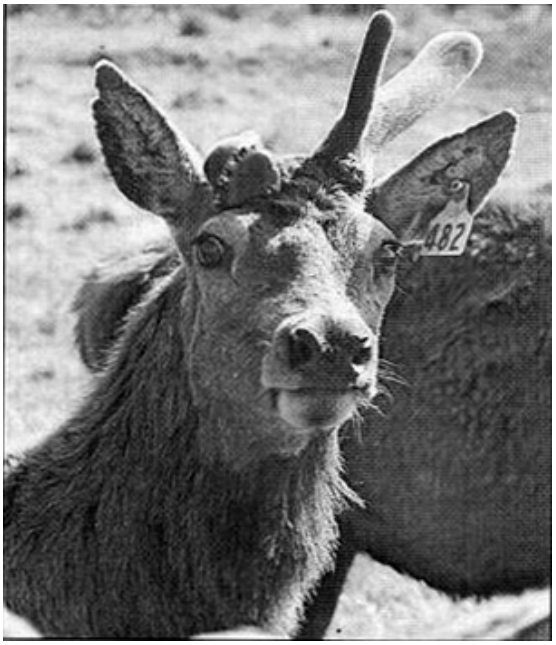
RAMBLING AROUND THE FARM – SOIL & HEALTH

By Andy Cowan

From the picture below you can see that the stag and I have a problem. Originally, I thought that there may have been some sort of nutritional problem as there was no obvious physical problem. Unfortunately the stag has died so subsequently I showed the photo to Dr Andrew Hansen. His response was: "My first thought would be injury/infection to the poll area with extension of the infection into the cranium. Deficiency diseases can affect antler growth but I can't think of anything that would produce that deformity on one side and poor growth on the other."

Regrettably I did not take the head of the stag to my Vet, so I do not know the reason for this problem. My records show that his velvet growth last year was obviously greater on the deformed side – about 20%. Before I had the response from Andrew Hansen I had started to wonder about the impact of minerals on velvet growth and the body generally. Although we feed both our stock and ourselves mineral supplements, it need not be so if we took more care of our soils.



Stag with deformed antler

Traditional Chinese Medicine promotes the attainment and maintenance of good health, rather than intervention due to illness. "While it has long been common belief that disease is an infliction visited upon us from without, there is growing recognition of its possible origin from within because of deficiencies and failures to nourish ourselves properly." *William A. Albrecht*. This belief concurs with what we have heard said so many times: "We are what we eat." Venison is highly regarded for its low fat and high iron content. Velvet has been a major component of Traditional Chinese Medicine "tonics" for many hundreds of years. As producers of those two wonderful food products, venison and velvet, we want to ensure that we are producing the best possible product. How can we do this?

John Fletcher points out in his book, "A Life For Deer", that game meat (venison) in the UK was traditionally fed on an endless variety of browse and flora in large game parks which translated into healthy, fast growing animals. "There are even rumors of calves conceiving at four months old in the very best woodlands." Compare this to an Australian farming situation where some hinds do not even conceive as yearlings.

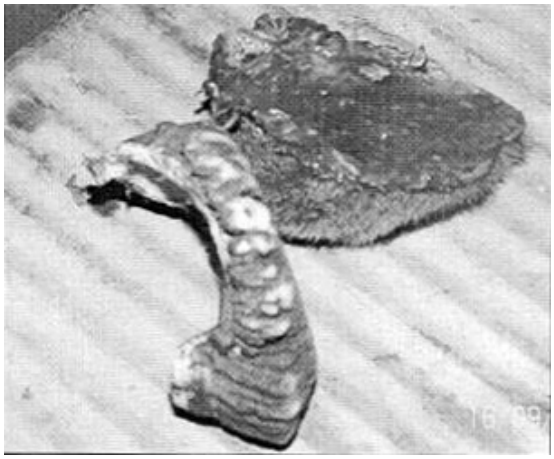
I think it was a New Zealand Vet/academic who said something to the effect of "if farmers knew how to feed animals properly there would be little need for Veterinarians." Since hearing that, it has continually amazed me that so much time and money has been spent in an effort to provide correct feeding and yet some animals still fail to thrive. Why is it so difficult to feed animals properly?

Interestingly, in 1836, Charles Darwin wrote of Australia ... "The rapid prosperity and future prospects of this colony are to me, not understanding these subjects, very puzzling. The two main exports are wool and whale-oil, and to both of these productions there is a limit. The country is totally unfit for canals, therefore there is not a very distant point, beyond which the land carriage of wool will not repay the expense of shearing and

Button still attached to velvet

tending sheep. Pasture everywhere is so thin that settlers have already pushed far into the interior. Moreover, the country inland becomes extremely poor. Agriculture, on account of the droughts, can never succeed on an extended scale. Therefore, so far as I can see, Australia must ultimately depend on being a centre for commerce for the southern hemisphere, and perhaps on her future manufactories. Possessing coal, she always has the moving power at hand. From the habitable country extending along the coast, and from her English extraction, she is sure to be a maritime nation. I formerly imagined that Australia would rise to be as grand and powerful a country as North America, but now it appears to me that such future grandeur is rather problematical." Maybe Darwin's caution over 170 years ago is truer than we would wish to believe.

Parts of Australia that have previously been seen as agricultural areas are now being reassessed. Some farmers have overstocked their land in order to make a living. Only on rare occasions have they earned enough money to look after their main asset – the soil. In the process of overstocking and under-maintaining the land, we have become a part of another great Australian tradition – mining. Instead of mining coal, gold or iron-ore in bulk over the last two centuries, we have been subtly mining minerals and organic matter from the land.



Shape of button after velvetting

It is probably fair to say that we cannot over-estimate the importance of minerals in the human body, plants and soil. They are the catalysts for the manufacture of vitamins and other nutrients that our bodies use for developing and maintaining good health. While vitamins can be synthesized by animals and plants, minerals must be supplied entirely by the environment. In other words, the quantity of mineral in a plant (which then gets passed on to the human who eats it) depends on how much mineral is in the soil in which the plant grows. Dr Alexis Carrel, Nobel Prize winner in Medicine (1912) said, "Minerals from the soil control the metabolism of cells in plants, in animals, and in man ... diseases are created chiefly by destroying the harmony reigning among mineral substances." So maybe we can trace the majority of the poor health of our livestock to a mineral deficiency in the soil.

It would probably not surprise anyone who has taken a soil sample recently and had it tested for "fertiliser needs" that a balance of all necessary minerals is important for plant growth especially calcium, magnesium, phosphorous, sodium and potassium. Minerals compose about 45% of most soils. The rest is air, soil solution (mainly water), organic matter and soil biota. By far the largest component of the mineral section of the soil is compounds of silicon, aluminium and iron – maybe 95% of the total of minerals present depending on the soil type and its parent material. As you can imagine, a sandy loam would have the largest concentration of silicon compounds in it. In round figures, a good clay loam soil may only have calcium, magnesium and sodium compounds, potash and phosphates totalling about 6% of the mineral component of the soil. This may, in fact, be the same percentage as the organic matter content of the soil.

Therein lies the problem – what do we interpret as "fertiliser needs"? Since the introduction of artificial, more soluble fertilisers, "fertiliser needs" have been based on the needs of the plant. It has only been in recent years, since organic food production became fashionable, that the needs of the soil have taken priority. According to many scientists in today's world, naturally occurring, nutrient-rich soils are becoming a thing of the past. Years of vegetative growth and aggressive modern farming techniques have brought many of the earth's minerals to the surface where they have been washed away. In these minerally depleted soils, man-made fertilizers provide only enough mineral substance to support basic plant life. Numerous trace minerals, so essential to human life, may never have been replenished.

Each of the cells in our body requires a constant supply of over 50 nutrients, 30 essential vitamins and 20 minerals. Unfortunately, grains and vegetables grown in soils leached of essential minerals no longer provide the nutrients needed for healthy metabolism of animals. Pesticides and food processing degrade the nutritional value of foods. Stress, caffeine, alcohol, drugs and "junk foods" actually leach vitamins and minerals from the human body. Interestingly, I think I eat pretty well. However my naturopath has, on occasions, recommended dietary supplements for me including calcium, magnesium, zinc, potassium and omega 3 fish oils. Obviously, despite having what I think is a balanced diet, these things are not available in the quantities my body needs from commercially grown foods.

Apparently, both calcium and magnesium are involved in numerous metabolic functions and are absolutely essential for the maintenance of a healthy body. Interestingly, there seems to be some common ground when talking about calcium and magnesium in the human body and soil. Calcium is considered the backbone mineral because of its role in the formation of skeleton and teeth. Some people say "calcium is the king" when talking about the soil. Magnesium is called the natural tranquilizer due to its relaxing action on the nerves and muscles.

There are some similarities between the soil and body mineral needs. The most important characteristic seems to be the requirement that, if the system (the soil, the plant or the body) is to function efficiently, there has to be a balance of all minerals involved. It is impossible to isolate one mineral and say that it is the most important. Although calcium and magnesium are two important nutrients, they cannot function without the help of other minerals, water and the correct pH. Next to water, minerals are the backbone of cell physiology. If the water supply is not adequate and the pH is not correct, nothing in the body works as it should. This is also the case with the soil. Without water, nothing grows. If the pH is not within a certain range, the uptake and function of many minerals is restricted.

It is difficult to find consistent figures indicating the chemical make-up of the human body and soils. Obviously there will be variations but it is interesting to get a very rough idea of the values in order to compare them. The Albrecht philosophy talks about the Cation Exchange Capacity (CEC) of a soil (65-70% calcium, 15-20% magnesium, 2-5%potassium, and less than 3% sodium). Many people remark that most of the soils on the planet are nothing like this. This is true so why is it so important? If the soils do not reach this "optimum level", what effect does it have? What are we missing out on by not having such soils? Compare this imbalance with the human population. There are 6 billion of us on the planet. According to the experts, there are not many people on the planet eating "properly". In some parts of the world, this has dire or fatal consequences. In other countries, many are surviving but they are not thriving. It is obvious that both humans and soils can tolerate large variations in their make-up but in order to thrive, there seems to be an "optimum level" of the necessary elements.

The following table outlines the approximate percentages of elements in the soil and the human body. The following figures are "very rubbery" and are intended only as a guide.

Element	**% of Element**	
	Soil	**Human Body**
Oxygen	46	65
Carbon	4	18
Hydrogen	6	9
Nitrogen *	20	3
Calcium	0.6	1.6
Magnesium	0.3	0.03
Potassium	1.5	0.4
Phosphorous	0.02	1.1

* These figures are very general. For example, the N value was calculated by referring to a table in Brady and Wiel which suggests that the N content of the solid framework of a temperate soil, 15cm deep, in a humid region is 3,500kg/ha. I have assumed that the bulk density of the soil is 1500kg/m3. This implies that the N percentage of this soil is 3500/(1500 x 10000 x 0.15) = 0.16%. Add to this the amount of N in the soil air – 78% of 25% of the "soil" – 19.6%. This makes a total of about 20% of the total moist soil being nitrogen. As you can see this is a very rough calculation.

From the literature I have read, the amount of calcium in the body varies between 0.5 to 2.0% of body weight. There is approximately 1,000g of calcium in the average 70kg adult body of which almost 98% is found in

bone, 1% in teeth, and the rest is found in blood, extra-cellular fluids and within cells. There are about 20g of magnesium in the average 70kg adult body, of which, approximately 65% is found in bone and teeth, and the rest is distributed between the blood, body fluids, organs and other tissue. As with calcium, the bones act as a reservoir for magnesium in times of need.

These figures reinforce the fact that there is a great variation in the mineral content of both the soil and variation in the mineral content of both the soil and the human body. However, there is more than likely an optimum amount of minerals required to be accessible for both systems to function properly. In the case of calcium and magnesium at least, the bones of the human and the organic matter and clay particles of the soil seem to hold reserves of each mineral which can be accessed in times of shortage. Both animals and soils have the capacity to store most minerals and both can survive a great range of minerals and still function quite well. So, if an animal is ill, think about your soil. It may be really out of whack and the cause of the problem. If you want to produce healthy animals, they key is in attaining and maintaining a healthy soil.

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