Soil - Fertiliser Retention

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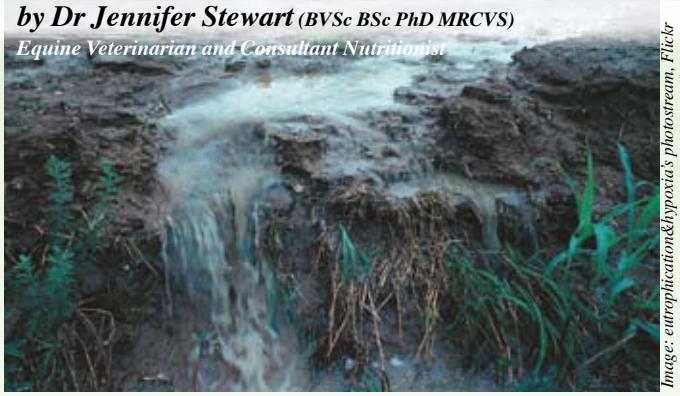

Image: eutrophication&hypoxia's photostream, Flickr

Above: Surface water/fertiliser runoff and pollution resulting from excessive fertiliser application.

Grazing horses on correct pastures produces natural advantages compared to systems that rely on hand-feeding, including highly digestible energy, protein and minerals, and many vitamins that are lost in hay, chaff and hard feed. In addition, minerals are conserved through recycling in urine and manure (60-80% of minerals are returned to the soil). Horses experience fewer veterinary problems such as colic, tying up and wood chewing. Horses turned out to pasture also have the opportunity for exercise and social interaction.

As good pasture can meet most of the nutritional needs of horses, it's worth investing some time into pasture management, especially management of manure and application of fertilisers.

SOIL CHARACTERISTICS

When establishing or improving pastures, it is important to remember that each property and each paddock is unique, and must be treated as such. Australian soils are amongst the lowest in the world in terms of phosphorus levels, but deficiencies in many other elements are common. According to Dr. Simon Leake from the Sydney Environmental and Soil Laboratory (SESL) (www.sesl.com.au), of particular concern to the well-being of both the pasture and the grazing animals are calcium, zinc, sulphur, selenium, cobalt, molybdenum and sometimes copper.

Cumulative data from decades of soil testing at SESL has shown that the phosphorus content of most Australian soils is low by world standards, and most soils east of the dividing range, and many of the light soils west of the range, will be acidic and hence calcium deficient. High salinity, alkalinity and sodicity (high sodium) may be a problem in areas with low rainfall in the north and south of Australia. Weakly developed soils, characterised by poor water retention and almost universally low fertility, are widespread in regions of low and erratic rainfall in the eastern half of the continent and parts of Western Australia. In high rainfall areas, soils may be strongly acidic, or highly alkaline if they contain calcium carbonate. Soils along the eastern coastline, in northern parts of WA, NT and the 'top end' are typically very iron-rich.

SOIL TESTING

A full response to fertilising cannot be anticipated if primary soil deficiencies have not been addressed, and a property can have many different soil types. To determine the presence and degree of nutrient deficiencies soil testing is required. When first embarking on a soil improvement program, and at intervals of 3–5 years thereafter, it is desirable to assess at the very least, pH, phosphorus, potassium and magnesium status. Soil pH, easily measured using a soil pH meter, measures the acidity or alkalinity on a scale of 0–14, with 7 being neutral. A pH of 6.5-6.8 should be maintained.

Key land limitations for horse keeping include soil erosion, waterlogging, salinity and pH.

FERTILISER PROGRAM

A well-planned fertiliser program can be one of the best investments, leading to more, and better quality pasture. Although it is difficult to generalise about the amounts of elements required, as these can only be confirmed by testing, Dr. Leake says that for horse properties it usually pays to build up the soil to optimum levels for high protein pasture production, which will include a legume component. A rough guide to the improvement of soils previously supporting native forest would be:

Phosphorus: 100-200kg per hectare (ha) – for example 1-2t of superphosphate/ha or 800 kg/ha of monoammonium phosphate
Lime: 5t/ha
Sulphur: 100 kg/ha or 550kg/ha of gypsum
Zinc sulphate: 40 kg/ha
Sodium molybdite to supply molybdenum at a rate 100-200g

These additions should bring most soils into some reasonable state of pasture productivity. Dr Leake also advises that 1 bag (25 kg) of superphosphate to the acre (roughly 2 bags/ha) will not result in a build up of phosphorus and in unimproved soils, will hardly result in any noticeable difference in pasture yield.

TOXICITIES & POLLUTION

When applying high rates of fertiliser an understanding of the effect on other nutrients is required. For example, properties applying molybdenum single superphosphate annually found the horses became copper deficient so it's important that all deficiencies be corrected as excesses of one mineral may limit others.

Lime is often used to increase soil pH and calcium levels, however if the soil has adequate pH and calcium, this is wasteful and in some cases dangerous because the amount of calcium to other minerals, particularly phosphorus, is critical.

Inappropriate fertiliser application is a major factor in land degradation as nutrients from human activities accumulate in soils and remain there for years, eventually making their way to either surface or ground water.

As an example, nitrogen has a turnover time of decades and the amount of phosphorus lost to surface waters increases linearly with the amount of phosphorus in the soil, resulting in adverse ecological and environmental effects such as increased supply of nutrients to an ecosystem (eutrophication), soil saturation and algal blooms.

A 500kg horse may ingest 1-2kg of soil per day, and although phosphorus is well tolerated by animals and excess amounts are usually simply excreted, the consequences of chronic excess are urinary calculi and nutritional secondary hyperparathyroidism (fibrous osteodystrophy) or big head disease.

Pasture mineral composition varies with plant species, season, soil type and fertiliser history. Most minerals, apart from iodine and cobalt, are required by plants for their growth, however the proportions taken up by the roots differ. There is generally a diminution up the plant chain (ie from soil to plant), as plants are to some extent, selective. They may concentrate nutrients that are present in luxury amounts, but there is a general adage in contamination work that if a mineral is high enough to harm an animal grazing it, then the plant would be dead.

Plants do not absorb significant amounts of heavy metals such as lead and cadmium, although the leaves may become contaminated by fallout; the soil and subsoil can be polluted by industrial seepage, and soil can become a source of lead and fluorine toxicity. Manure such as poultry manure, are also commonly used and supply most minerals, however they can be contaminated by ionophores, which cause health problems for horses.

FINDING THE BALANCE

The economic value and return on investment of correct fertilisation can be substantial. Correct application of fertilisers can increase by up to 10 times the amount of grass produced and protein content 2-3 times, significantly reducing the amount of hand-feeding required. Most well-managed pastures provide adequate macrominerals, but not necessarily trace minerals, and feed blocks have been recommended as a source of supplementation. Pastures are an excellent source of many vitamins found in low levels or not at all in dry feed, including vitamins K, A, C and E, and vitamin supplementation is probably unnecessary in most pasture-fed horses.

Resources

Excellent sources of information on pastures for horses and pasture management practices are available from the Department of Agriculture in each state, the CSIRO, the Rural Industries Research and Development Corporation (RIRDC) and the following websites:

www.test.agric.wa.gov.au/
www.dpi.nsw.gov.au
www.nt.gov.au
www.pir.sa.gov.au
www.dpi.qld.gov.au
www.publish.csiro.au/samples/ManagingHorsesSample.pdf
www.rirdc.infoservices.com.au/downloads/97-003.pdf
www.sesl.com.au