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Trace Elements for Dryland Pastures

Trace element requirements for pastures in various parts of Victoria are assessed from knowledge of the soil type, local trials and plant tissue testing.

Introduction

Although only required in small amounts, trace elements (or micronutrients) are essential for plant growth. These nutrients often act as catalysts in chemical reactions. It is possible to have toxicities of trace elements, as well as deficiencies. Particular trace element deficiencies are generally restricted to specific soil types or localities. A deficiency will reduce the growth and yield potential of pasture plants. An excess of a trace element, although not common, may be toxic to the plant and may cause an imbalance, reduced yield, impaired quality or increased susceptibility to disease.

The trace elements considered to be essential for plant growth include molybdenum, manganese, iron, copper, zinc, boron, chloride, sodium and cobalt.

Trace elements are also necessary for animals as well as plants. In fact some of the trace element deficiencies in plants can cause nutrient deficiencies in the animals that graze those plants.

Testing trace element status of pasture

Where a trace element deficiency/toxicity is suspected, tissue tests, also known as plant tissue analysis, should be considered before application of trace elements. Plant tissue testing is the preferred method for diagnosing trace element status of a pasture. Research has reported poor correlations between the levels of trace elements measured in soil tests against the responses to trace elements in the paddock. Therefore soil testing for trace elements is not recommended.

If wishing to assess the trace element requirements for pasture growth, a sample of the most dominant clover in the paddock is taken in late winter/spring, and submitted to a reputable laboratory. Kits with sampling instructions are available. Results should be interpreted by a trained professional and where possible local knowledge should be combined with the results before finalising a course of action. In addition, recommendations should be based on research conducted in Australian soils or on Australian plants, not on overseas data.

Molybdenum

The most common trace element required for Victorian pastures is molybdenum. The availability of molybdenum to plants is related to soil acidity (or pH) and soil type (e.g. gravel content). Clovers, medics and brassica fodder crops are generally sensitive to molybdenum deficiency. The more acid the soil, the lower the availability of molybdenum for plant uptake. Liming which has the effect of reducing acidity, will often increase the availability of molybdenum already in the soil, but molybdenum responses are far cheaper to achieve through an application of molybdenum than through lime application.

Molybdenum toxicity is not thought to be significant in plants, but excessive molybdenum levels in plants or high rates of molybdenum applications in fertilisers can sometimes induce copper deficiency in livestock. Therefore, it is generally recommended that copper be included in the fertiliser whenever you apply molybdenum.

Molybdenum is recommended routinely on acid soils in north east Victoria, Gippsland and parts of central and western Victoria, however, molybdenum should not be applied to peats, which usually have high molybdenum levels within the organic matter. Where required, molybdenum is normally applied at 50-60 grams/ha with the fertiliser every 5-6 years. Molybdenum can also be applied as a foliar spray but the normal application method in Victoria is via the fertiliser.

Boron

Boron may be required on lucerne stands frequently cut for hay in North East Victoria or East Gippsland but pasture responses to applied boron are very rare. Boron deficiencies in pastures can occasionally occur along some coastal soils. If plant tissue analysis indicates a need, seek expert advice to determine the appropriate boron type and application rate.

Zinc

Zinc may be required on light textured soils such as sands or sandy loams and particularly those that are alkaline. The more alkaline the soil, the lower the availability of zinc for plant uptake. Most of the alkaline soils in Victoria occur in the Wimmera/Mallee but there are a few pockets of alkaline soils

in the higher rainfall areas of the state. Zinc responses on pasture are rare, but where required zinc should be applied at about 1-2 kg/ha, every 5-6 years.

Other trace elements

Trace element deficiencies of iron and manganese in pasture, are either extremely rare or unknown. Other nutrients (such as aluminium) can be toxic to plants when levels in the soil are high. This is the case in certain soil types or where the soil is more acidic, which makes the aluminium more available to plants.

Be wary of people promoting "wonder formulations" containing a range of trace elements. To a plant, all essential elements are of equal importance and the only difference between the major elements and the micronutrients is the quantities required. Plant tissue tests should be used to assess likely requirements for trace elements.

Trace elements for animal health

Trace elements are also required for animal growth. The trace element levels in plants can cause nutrient deficiencies in the animals that graze those plants. In some cases (for example, copper and manganese), trace elements are essential for plant and animal growth. In other cases (for example, selenium), they are required by animals but not by plants. Thus, in many cases of animal nutrient deficiency it may be better, and usually more economical to treat the animal rather than to apply fertilisers to overcome the problem. It is therefore important to discuss trace element issues with your local veterinarian.

Plant tissue testing is the recommended method for testing for trace element disorders in plants, but it can be unreliable for testing for some trace elements required for animal nutrition. If plants are tested for a suspected animal health trace element deficiency a representative sample of what the animals are actually eating is required (referred to as a mixed herbage sample). Testing of body fluids (blood, urine, saliva), tissues (liver, bone) is often required and preferable to determine whether animals have a trace element disorder. Seeking veterinary advice in addition to, or instead of, plant tissue testing is recommended. Trace elements commonly assessed in relation to animal health are selenium, cobalt and copper.

Copper

Although plants do have a requirement for copper, the main reason copper is applied is for the benefit of grazing stock. Copper deficiency is more common on light textured soils such as sands or sandy loams. Where required, copper is

normally applied with the fertiliser at 1-2 kg/ha every 3-6 years. Inclusion of copper in the fertiliser will provide a long term supply to pasture and grazing stock. Where copper deficiency has been diagnosed in stock, more direct supplementation such as copper drenches are recommended. Copper is commonly applied in southern Victoria and on lighter soil types in western Victoria and parts of Gippsland whenever molybdenum is applied. Copper is not normally applied in northern Victoria.

Excessive intake of molybdenum, either directly through ingestion of fertiliser (e.g. Super plus Molybdenum dust on pasture), or indirectly through intake of high molybdenum herbage (e.g. herbage from peaty soils), can induce a copper deficiency in livestock.

Cobalt and selenium

When stock are deficient in cobalt and selenium, direct supplementation (e.g. pellets, drenches and injections) is the recommended treatment. Including selenium in the fertiliser can provide up to two years protection and could also be considered as a supplementation option. Consult your local veterinarian regarding direct supplementation options.

Further References

For further information on a range of other trace elements, refer to the publication "Trace elements for pasture and animals in Victoria", which was prepared by W.J Hosking, I.W Cagle, C.G Halpin, A.J Brown, D.I Paynter, D.N Conley and P.L North-Coombes of the former Department of Agriculture and Rural Affairs in 1986. This publication provided a review of the then state of knowledge about the role of trace elements in Victorian grazing enterprises and has not altered since. It provides an important source of information of interest to a wide audience. The review also includes an extensive bibliography of both published and unpublished reports on trace element research work conducted by the former Department, as well as other published papers relevant to Victoria at that time. The publication is available at the Victorian Resources Online web site: www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/trace_elements_pastures

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