

FACTSHEET

Molybdenum in pastures – background and diagnosis

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Molybdenum (Mo) is an essential micronutrient particularly for clovers as it plays a key role in N-fixation.

Molybdenum (Mo) is an important micronutrient for nitrogen (N) metabolism in plants. It helps create proteins in plant leaf cells and is required for N fixation in legumes.

Molybdenum in the soil

Mo availability from the soil declines when the pH is below 6. Therefore, adding lime can increase the availability of Mo to plants. A response to Mo fertiliser is unlikely above a pH of 6.0 unless the soil is naturally low in Mo. A range of New Zealand soils are naturally deficient in Mo. The following map indicates where Mo deficient soils were identified by trials carried out in the 1950's.

Since then, Mo has been widely applied and many of the soils limed. Therefore, other factors must also be considered when assessing pasture Mo status.



There are no suitable soil tests for Mo so testing clover foliage is the best tool currently available to assess pasture Mo status.



Left: healthy subterranean (sub) clover. Right: N-deficient sub clover which can occur when Mo is deficient as N-fixation is affected. Photo: Snowball and Robson (1983).

Molybdenum in pasture

Legumes have a high requirement for Mo during establishment and nodulation because it aids nitrogen transformations in the plant affecting both N fixation and assimilation.

Often the only sign of Mo deficiency is poor pasture growth. The clover may appear N deficient being stunted with pale green or yellow leaves because N fixation has been affected. Routine clover foliage sampling in spring can check that the clover nutrition is adequate so that action can be taken before plant growth is affected.

If white clover foliar Mo is <0.1 mg/kg **and** N is <4.5% there is a high probability of a pasture production response to Mo addition (Morton 2019).

Mo fertiliser additions

Standard Mo fertiliser application rates for pastures are low, 20-40g Mo/ha (50-100 g/ha of Sodium Molybdate which is 40% Mo), and is required every 4 to 5 years (Morton 2019).

Because of the very small amounts, Mo is typically applied to pastures with other fertilisers such as superphosphate.

Key messages

- Optimising clover nutrient levels benefits pasture yield and quality.
- The nutrient analysis of clover foliage sampled in spring is the most accurate tool to assess Mo nutrition. Foliar N concentrations must also be considered when diagnosing Mo deficiency.
- If unsure about the Mo status of the pasture, a simple field test can be carried out. A protocol for this is in development.

Note: high levels of foliar Mo can cause a Mo-copper imbalance in grazing animals. Problems with induced copper deficiency can occur at levels above 1 mg/kg and more typically above 2 mg/kg. Ensure recommended rates and timing of Mo fertiliser application and test the clover foliage to ensure Mo levels are safe.

Diagnosing Mo deficiency

To make an accurate diagnosis of pasture Mo deficiency, ask the following questions:

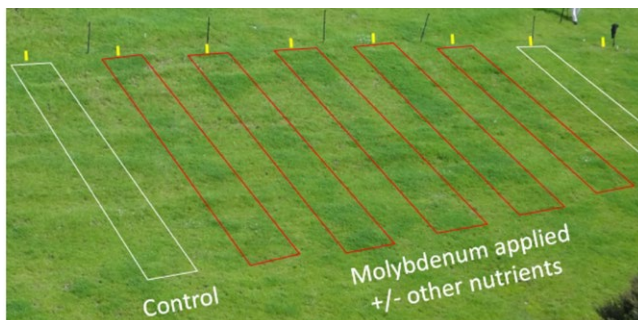
- Is the farm's soil type inherently Mo deficient?
- What is the soil pH? **Check latest soil test results.**
- When was Mo fertiliser or lime last applied? **Check farm records.**
- Were the clover foliar concentrations of N and Mo low in spring? **Check foliage analysis results.**
- Is clover vigour/growth a concern? **Look at the pasture.**

If there is uncertainty about the Mo status of the clover/legume, a field test could be carried out.

Mo field testing

In March 2017, an experiment with combinations of +/- phosphorus (P), sulphur (S), potassium (K) and Mo was installed on a Wairarapa farm hillslope where sub clover (*Trifolium subterraneum*) had been looking unhealthy the previous spring (foliar Mo was <0.1 mg/kg and N was 4.1%).

Mo was applied at 60 g/ha as a liquid using a watering can. In October 2017 there was a visual response to the addition of Mo observed as darker green patches of sub clover:



A visual assessment of clover vigour rated the control plots 2.8 out of 10, plots with Mo alone scored 5.0 and plots receiving Mo + other nutrients 6.0 to 7.0.



Foreground - sub clover in a plot that received P+K+Mo.

These results were replicated on the Port Hills in Canterbury with sub clover and white clover growing in a dryland pasture.

For a clover response to Mo to occur, other macronutrients, such as P and S, need to be sufficiently available.

Applying Mo to pastures

Molybdenum is applied to clover-grass pastures once every 4 to 5 years, with the requirement for Mo confirmed by foliage testing. As Mo is a micronutrient and required in small amounts, it is added as a component of macronutrient fertilisers such as superphosphate to allow ease of spread on to pastures.

Depending on the fertiliser supplier, pre-mixed Molybdenum Superphosphate products are available, or Mo can be added into macronutrient fertilisers on request. These options can be discussed with local fertiliser representatives.

REFERENCES:

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