2004/V09

Producer Research Support

Boron and cobalt in beef pastures (Research)

East Gippsland Beef Improvement Association

The East Gippsland Beef Improvement Association conducted this project to validate the impact of boron rates (using calcium boronate) with and without cobalt on beef pastures in East Gippsland.

They aimed to use the outcomes of this Producer Research Support project to provide more precise information on the best rates of boron (calcium boronate) to use in pasture systems.

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The project

The first recorded pasture responses to boron in Australia were on the Southern Tablelands of New South Wales in 1948. This was three years after the trials were established in 1946. (Jn. Aust. Inst. Ag. Sc, Sept. 1952). In part this is due to boron deficiency impacting the seed production of annual legumes and thus its density in pasture.

Old top dressed paddocks that have acidified and then limed were identified as underperforming compared to more recently developed pastures on 16 beef producing properties across East Gippsland.

Results from Producer Research Support project 2002/V04 indicated that the issue was most likely due to a deficiency of boron and cobalt caused by the calcium applied in lime. These nutrients are important for the growth of legumes and the process of nitrogen fixation. Past research on legumes has identified these nutrients as likely to be deficient if in marginal supply and large amounts of calcium were applied to the soil.

The observed pasture impact has been severe nitrogen deficiency caused by the inability of legumes to thrive and fix adequate levels of nitrogen thus enabling vigorous grass growth.

Objectives

1. Produce information on the effectiveness of calcium boronate as a boron fertiliser in high rainfall pastures;
2. Establish whether there is a cobalt boron interaction occurring in these pastures or whether the cobalt deficiency is induced by insufficient boron being applied; and
3. Determine whether the diagnosis of these deficiencies can be improved along with their methods of treatment.

What was done

Three pasture trials were established in autumn 2004 and two in autumn 2005 to investigate the impact of boron and cobalt on the growth and composition on east Gippsland pastures. Sites were established at Flynn, Orbost and Bruthen in 2004 and Ensay and Sarsfield in 2005.

Since establishment, the winter rainfall at all sites has been poor, however the variable spring rainfall has provided sufficient moisture to generate adequate levels of pasture growth for assessment.

With funds provided by Landcare the project was expanded to include a range of activities, all of which were concerned with improving the effectiveness of irrigation practices. This project was very well managed. Significant inputs were provided by a range of resource people which added substantially to the effectiveness of project operation.

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Producer Research Support

MLA Producer Research Support offers support funding of up to $15,000 over three years for groups of producers keen to be active in on-farm research and demonstration trials.

These activities include:

- Producer Initiated Research and Development
- More Beef from Pastures demonstration trials
- Prime Time Wean More Lambs demonstration trials
- Sustainable and productive grazing grants.

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What happened?

Flynn and Orbost

Capeweed dominated both sites and necessitated spraying (early spring) followed by reseeding with white clover. Some white clover was established across these sites, but at poor density (5 plants/m2). For this reason, only plant tissue tests and not herbage yields were taken in spring 2005.

Bruthen

This site has returned to a healthy vigorous white clover ryegrass pasture as a consequence of applying molybdenum in 2004. The boron and cobalt applications have given no visual impacts and the 2004 plant tissue testing indicated that these nutrients were not an issue at this site.

Sarsfield and Ensay

These two new sites were established on soils known to be boron and possibly cobalt deficient. The Sarsfield site (coastal) gave good sub-clover responses to boron when applied to unreplicated test strips in 2004. A new site using replicated treatments was established in an adjoining area in autumn 2005. The Ensay site (mountain) is granite-based and is know to have a low boron level. Lucerne and brassicas grown of this soil type need boron additions. Plant tissue and soil tests along with dry matter yields were obtained from both these sites in 2005.

Visual evidence of boron toxicity in clover at the high rate used (6kg/ha elemental water soluble boron) did not occur apart from the Sarsfield site (observed at the Bruthen site at low and high rates). Yield results from Sarsfield indicate a significant growth reduction at the highest rate.

This result may be due to the very dry conditions after autumn topdressing as normal rains did not occur until mid spring.

Ensay Yield Data (November 2005)

Even though seeded with sub-clover at establishment, this site had a patchy cover of clover. No significant responses to the applied treatments occurred. Plant tissue tests indicated that the molybdenum levels were deficient.

Sarsfield Yield Data (October 2005)

This site had patchy sub-clover growth over sections of the trial area with other minor legumes filling the site. From past experience, when sub-clover is growing vigorously it displaces other legumes. Because of this variability, the sub-clover density of the treatments was not measured.

This patchyness was attributed to potassium deficiency in early spring (strong clover growth in urine patches), thus an additional 200kg/ha of muriate of potash was applied to the site. It did not fix the problem because it was most likely due to molybdenum deficiency.

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Discussion

The results from this project have been disappointing and as a consequence no field days were held. Outcomes from these trials will be reported back to the East Gippsland Beef Improvement Association and producer groups associated with the sites during 2006.

Over the last four years a better understanding on the nature of the problem has been obtained, however practical information that can be readily adopted on farm has yet to be achieved.

The plant tissue tests from the second year sites indicate that the water insoluble product (Ulexite) applied at 1.5kg/ha elemental provided sufficient boron to cover legume needs.

Recorded plant responses to boron in horticulture and pasture (brassicas and lucerne) have been obtained when the plants are grown as a monoculture. With pasture, a mix of legumes and grasses occur, but it's the legume component that's more susceptible to boron deficiency. Where there is long-term deficiency, the sub-clover vigor of the pasture may take time to fully recover as seed production is impacted by boron deficiency.

Other deficient nutrients will impact the boron response, in this case molybdenum. A basal fertiliser containing molybdenum was applied to all sites in autumn 2004 and 2005. The plant tissue tests indicate that this nutrient may not have been in the basal mix in 2005 or it was mixed poorly. (The expected spring levels after an autumn application of 150gm/ha sodium molybdate is 1.5 – 2 ppm). The strong interaction between molybdenum and boron on clover growth is well researched and recognised.

Data is generated on the calcium:boron ratio in the soil test because both these nutrients are related and calcium is known to impact on plant boron uptake. This ratio may provide a better soil test guide to boron needs than just the plain boron test.

Because of the large amount of calcium in the topsoil, the legume type may have to be changed to accommodate altered levels of this nutrient. The brachycalycinum group of sub-clovers may perform better than the subterranean group used in this trial series. This will be investigated in 2006.

The focus of these results has been on boron rather than cobalt. The recommended cobalt levels in herbage for rumen livestock is 0.11mg/kg dry matter or above. (Feeding Standards for Australian Livestock. Ruminants, CSIRO 1990.)

The clover cobalt levels as indicted by plant tissue tests are at or just above this level, thus given that grass has a much lower level of cobalt, the amount of clover in the diet in the tested pastures would be critical to meeting the animal dietary cobalt needs.

Next steps

The results from 2005 have been disappointing, however with these sites now established, it is proposed to continue four of them (Flynn, Orbost, Sarsfield and Ensay) for another year.

The sites have generated interest from the local farming community, however to date only minor practical outcomes have been generated. Responses to treatment have occurred at all these sites but not in the replicated experiments.

In running these sites in 2006, it is proposed to keep the clover content at 50% or higher during the plant growing period.

Depending on outcomes, field days will be held at the sites in spring 2006 and some practical guidelines on the use of boron and cobalt on pastures should be established.

MLA also recommends

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