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PROVINCE OF KWAZULU-NATAL

Research & Technology
BULLETIN
2016/05

Ryegrass for dairy: get your soils right

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Successful, productive pastures are aided by proper preparation and planning, starting at least three months before any pasture seed is sown. Ongoing management in terms of grazing, moisture and fertiliser use will then determine the longevity and continued quality of your pastures.

Soil acidity build-up

Soil acidity has a major effect on ryegrass pasture production (Figures 1 and 2). Soil acidity restricts production and greatly limits future options for pasture and crop species. Adding nutrients already in adequate supply will not compensate for other limiting factors such as acid soils. It can also predispose pastures to disease, as the defence mechanisms of a weakened plant cannot function optimally. A case study of an isolated leaf spot outbreak in the USA revealed excessively low soil pH. Despite ideal environmental conditions the acidic soil conditions had stressed the pasture, making it susceptible to disease.

FIGURE 1 Acid saturation restricts ryegrass yields

Perennial ryegrass yields are affected more by soil acidity than annual ryegrass. Research conducted in the USA found that failure in annual ryegrass stands can occur if soil pH levels are below 4.8 while perennial ryegrass stands can fail at soil pH levels less than 5. Liming is recommended if soil pH is below 5.5.

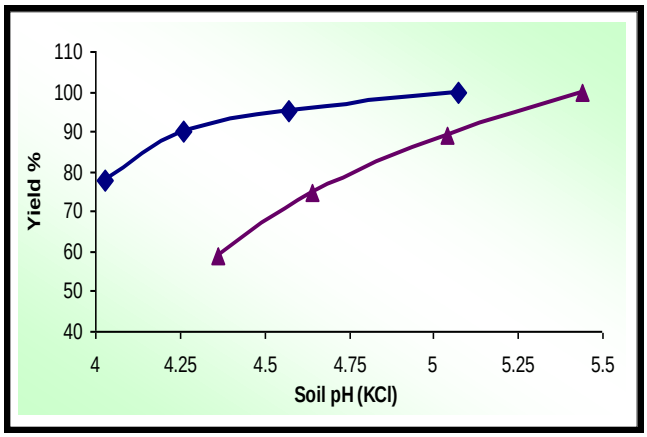

FIGURE 2 Soil acidity effects on the yields of annual and perennial ryegrass

All nitrogen fertilisers generate acidity in the soil to various degrees, depending on their chemistry. The ammonium in nitrogen fertilisers is changed by bacteria living in the soil to forms which can bind to calcium and magnesium in the soil. Over time the nitrogen is leached out of the soil, taking with it the calcium and magnesium. Acidification is least when the bulk of the applied nitrogen is taken up by the roots as then there are not high levels of free nitrates in the soil for an extended period of time. When more nitrogen than the plant requires is put down, acidification can be severe.

Trials conducted over the past year at Cedara show that after only one year the pH of soil under perennial ryegrass dropped enough to affect production in the

second year. The soil was limed at the beginning of the trial with 2t Dolomitic lime ha^{-1}. Most plants require the pH of all parts of the root zone to be above pH 5.0 for maximum growth rates to be achieved.

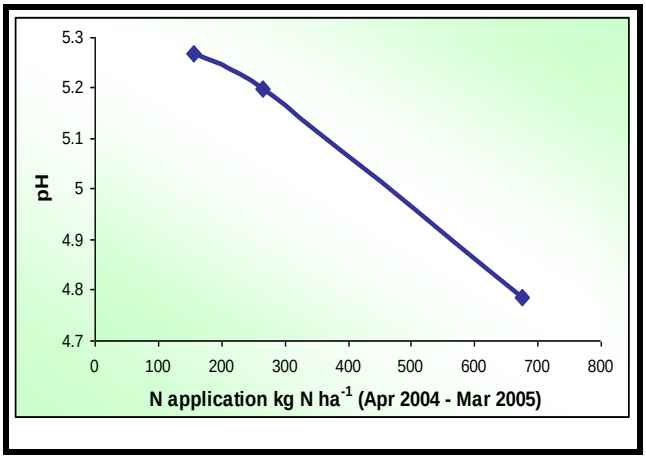

FIGURE 3 Effect of N fertiliser on pH

Therefore, in addition to excessive nitrogen applications being expensive and having no benefit in terms of pasture yields, they could contribute to extra long-term lime requirements to correct the acidity generated. Liming and on-going management of soil acidity is vital to ensure continued production off pastures.

Soil compaction

Soil compaction can contribute significantly to decreased ryegrass pasture production in the KwaZulu-Natal Midlands. Soil compaction is the formation of dense layers of well packed soil, often at the bottom of the cultivated layer. It is usually caused by animal treading and tractor and implement wheels travelling over moist, loose soils.

a) What happens in a compacted soil?

Root growth is restricted. This decreases the water and nutrient uptake by plants and so plant growth and yields are reduced.

FIGURE 4 Compacted soil

Recent research has shown animal treading has significant effects on the seasonal and total yield of perennial ryegrass. Research in New Zealand found that simulated cattle treading resulted in a reduction in ryegrass yield of up to 15% for an individual harvest or 10% over the whole season, even when methods to minimise plant damage were implemented. On-farm yield reduction is likely to be even greater because animal grazing also affects plant growth by damaging the plant and smearing of the soil surface. Another New Zealand study reported dairy-pasture yield reduction of 41% and 76% for moderate and severe pugging damage (when stock intensively trample wet soil, the soil aggregates are broken down, and spaces in the soil are reduced) respectively. It has also been reported that there is an association between subsoil compaction and “pulling”, whereby dairy cows inadvertently uproot ryegrass clumps during grazing, probably as a result of poor root growth.

Soil compaction decreases the size of soil pores, which affects the water-holding capacity of the soil and the activity levels of soil microorganisms. This leads to decreased rates of soil organic matter decomposition and hence the availability of nutrients for uptake by plants. Smaller soil pore size also decreases infiltration rates, which increases the likelihood of runoff and erosion.

b) Compaction results in:

- poor drainage – wet soil is susceptible to further pugging
- poor plant growth – a reduction in pasture yield
- greater fertiliser requirements
- greater runoff and erosion – contamination of waterways with topsoil and agrochemicals.

FIGURE 5 Effect of soil compaction on root growth

c) To minimise soil compaction:

- Try and keep off the field when the soil is wet, particularly with heavy equipment. The carrying capacity of dry soil is much greater than that of moist soil.
- In annual pastures, use rotations that include forages/cereals and plough annual pastures in rather than baling them to help build up soil organic content and structure.
- Leave forage crops in for more than 1 year to reduce the continued working of the soil.
- If you must use annual pastures, try and change tillage depths so that plough pans are not created, or, even better, use minimum till.
- Minimize the amount of traffic on a field.

Soil testing

To offer pastures the optimal conditions for establishment, soils need to be in the best condition possible before planting. A soil test leading up to land preparation and sowing allows one to carry out any critical soil improvement activities timeously.

A soil test indicates the relative status of your soil for key nutrients such as phosphorus, potassium and zinc. It also indicates the soil pH and aluminium levels (important for acid sensitive species such as ryegrass).

a) How to soil sample

- Use a Beater soil auger (available for use from Cedara Analytical Services reception).
- Sample to a depth of 10 cm (maintenance) or 15 cm (establishment).
- Take 30 to 40 cores per hectare in a zigzag pattern across the field (Figure 9).
- Avoid gateways, areas near water troughs, dung patches and urine spots.
- Mix all cores from a field thoroughly and place in a sample box provided by the Cedara soils laboratory.
- Fill in soil analysis request form.
- Payment to be made at the time of submission
- Try not to leave samples for more than a day before getting to the lab. Store in a fridge if you are unable to deliver the sample to the lab within a day.

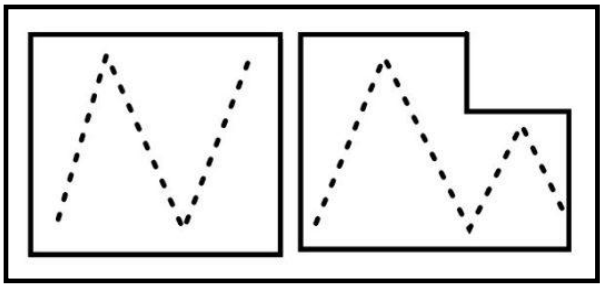

FIGURE 6 Sample in a zigzag pattern across the field

b) Where to send the soil sample

The Soils Laboratory at Cedara will test your sample for a fee. The results will be emailed.

c) What do the results say?

The printout gives the recommended nitrogen, phosphorus, potassium and lime for the particular pasture selected on the submission form. It will also list some of the fertiliser options available and how many bags of each will be required per hectare.

Correct soil fertility

Soil fertility is vital because it affects both the quantity and quality of the forage. Cultivated lands use up nutrients in the soil faster than they can be replaced naturally. These nutrients must be replaced to ensure that: plant growth is not limited; the plant material has a high level of nutrients; and the balance of nutrients and soil pH is correct. By following recommendations provided with soil test results, one will apply the correct amount of fertilizer with the correct balance of nutrients required by pasture plants.

Phosphorus and potassium should be incorporated into the soil before planting and can be applied during land preparation.

FIGURE 7 Effect of soil K deficiency on pasture growth

Small amounts of nitrogen at sowing (10-20 kg N ha^{-1}) can be beneficial for establishing pasture seedlings, especially on lighter-textured soils. The nitrogen stimulates early growth of pasture seedlings and helps their rapid establishment.

FIGURE 8 Annual ryegrass N response

Additional nitrogen can be topdressed soon after establishment to continue the rapid growth of the pasture. Annual N maintenance applications should be split over the growing season.

Deficiencies of other nutrients (e.g. sulphur) can be detected using a soil or leaf tests.

FIGURE 9 Poor winter growth due to N deficiency

Conclusions

There are many reasons why pastures may not be as productive as seed suppliers promise. South Africa has vastly different conditions to those in which most of our temperate pasture varieties were bred, such as New Zealand and Europe. Management is therefore critical to get the most out of a pasture. Ensuring there are no soil acidity, soil compaction or fertility problems will go a long way in helping to maximise both pasture and animal production.

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Published December 2016