Detection of elemental response with the use of fertiliser test strips

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Abstract

Results are presented which clearly show both sulphur (S) and phosphorus (P) responses using triple and single superphosphate under a design specifically used to highlight P and S differences in pasture growth over a two- year period. Cut and weigh techniques gave good estimates of dry matter (DM) responses in a good rainfall year where spring growth was prolific and moisture was not limiting. Further DM responses are shown which indicate responses to Molybdenum (Mo) as a consideration where trace elements are required. Soil level results indicate differences after treatment applications. The value of test strips as an aid to fertiliser decisions is discussed.

Key Words

Fertiliser extension, single superphosphate, triple superphosphate.

Introduction

Many grazing areas in Southern Australia have had much lower levels of superphosphate applied over the past five to ten years due to lower wool prices and poor returns from grazing enterprises. The two major elements supplied by superphosphate are P and S but it is difficult to determine which element pasture is responding to in any application of single superphosphate without soil or tissue testing or test strip areas (1). Due to the availability of different P fertilisers, such as single, triple and double superphosphate it is now critical to know the element required when deciding on fertiliser strategies. The sulphur is supplied in highest concentration in single superphosphate (11%), followed by double (5%) and triple superphosphate (1%). The large difference in S concentration between single and triple superphosphate allows the use of the two fertiliser types to examine responses to S.

The aim of this paper is to highlight some results from a recent set of such strips showing responses to both P and S. The design and responses for the trace element Mo, where adequate levels of copper are present, is also discussed together with some of the options in size in laying out test strips and their length of use.

Methods

The site was located near Oatlands in the Southern Midlands of Tasmania in a 490-mm annual rainfall area. The main pasture species involve perennial ryegrass (*Lolium perenne*), barley grass (*Hordeum leporinum*), bromes (*Bromus spp*) and subterranean clover (*Trifolium subterraneum*). The area had not received any fertiliser application for 6 years prior to this experiment. Soil test results from the area prior to treatment indicated pH water results at 6.0, Olsen P (2) at 15 ppm and K levels at 610 ppm. This indicated likely response to applied P and little need for lime or potash. Critical levels for P are near 18 ppm, pH 5.0 and K 210 ppm. The layout of the site included two replicates of all treatments.

Single and triple superphosphate were applied at rates chosen to apply comparable amounts of elemental P with two rates of S. 5x2 m areas per treatment were applied in autumn after mowing to even up area in pasture availability. Soil samples were taken prior to treatment application and analysed for levels of pH (water), P and K. No soil tests for S was undertaken as there is no reliably calibrated S soil test (3). The treatments were applied at random across the site and a control strip was used as a base for comparison of no fertiliser application. Chelated Mo was applied, at the equivalent rate of 122 g/ha Mo across each end of the strips at 1.25 m width to allow responses to be detected. The application rates are shown in Table 1. The strips were mown with a lawn mower and catcher in the early spring and the cut material dried and weighed for determination of growth responses. The cut material was not returned to any treatment sites. At no time was the area grazed during the estimation of fertiliser response.

Results

Table 1. Pasture growth response relative to nil major element for phosphorus (P), sulphur (S) and molybdenum (Mo) fertiliser combinations. For nil major element growth was 882 kg/ha from 4 April to 2 October.

Treatment (kg/ha)	P	S	Major element	Mo (122 g/ha)
Control	0	0	100	162
102 Triple	1.5	22	144	88
204 Triple	3.0	44	158	116
125 Single	14	11	267	362
250 Single	28	22	226	367

These rates of single superphosphate are typical of annual dressings to grazed pasture. Soil test results showed rises in Olsen P from 15 to 26 in response to P applied at 250 kg/ha single superphosphate at a pH of 6.0 in water.

The early spring results shown here indicate responses to P, S and Mo (Table 1). Dry matter increases of almost 50% occurred in response to triple superphosphate compared to the control and increased a further 100% in response to single superphosphate. With the addition of Mo the DM response was improved dramatically in all treatments where S was present. The DM response of Mo combined with triple superphosphate is low with no obvious explanation. We suggest that perhaps when triple superphosphate is used the S is more limiting to plant growth than the Mo. Although there appears to be a P response at the low and high rate of triple superphosphate rates, the greatest DM response was where P, S and Mo are applied together, and there is little rate effect within fertiliser type.

Results indicate dry matter responses to P, S and Mo from the test strip area used. The use of test strips allow the identification of elemental responses to be made with normal commercial fertiliser products such as single and triple superphosphates. These strips should only be retained for a relatively short period of 1 to 3 years at maximum, since exclusion of stock results in minimal nutrient recycling. The removal of nutrients in the dry matter from large areas like our cut and weigh system also makes the strips atypical of a true grazing system.

Although the statistical rigour of this approach is often poor, due to low replication it highlights the value of test strips where responses are large enough to show visible differences along treatment boundaries. The main conclusion to be drawn from this extension aid aimed at encouraging more efficient use of fertiliser strategies, is how important it is to choose and use the correct type of fertiliser on commercial grazing enterprises. In addition, the dimensions of the treatment areas allow producers to easily relate to the test strips, since the fertiliser expressed in grams (10^{-3} kilograms) used on the 10 m^2 areas (10^{-3} ha) equates to an application of the same fertiliser rate in kg/ha.

Conclusion

Tests strips are not regarded as being of great use in determining rates of application, but are useful for examining nutrient responses. Rate response studies require extra treatments above those used for element response, and require a more complex layout. Awareness of these shortcomings can make test strips a useful, cheap and minimal effort approach to better fertiliser strategies. More work is needed to study the effects of the ratio of P:S used in Australian superphosphates.

References

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