ARGOS

AGRICULTURE RESEARCH GROUP ON SUSTAINABILITY

ARGOS RESEARCH NOTE: NUMBER 30, JANUARY 2007

Soil Phosphorus and Sulphur levels in Sheep & Beef farms

Agricultural importance of P and S

The addition of phosphorus (P) and sulphur (S) to NZ soils has been critical for the development of the agricultural pastoral industries The cost-competitive advantage of NZ agriculture is largely because our grazing systems have used grass/legume associations to great effect. Nitrogen (N) fixed by clovers is eventually available for uptake by higher fertility grasses, increasing pasture response and dry matter (DM) production. White clover in particular, as the main N-fixing pasture component, responds strongly to P application Generally the optimal range for Olsen-P for Sheep & Beef (S&B) systems is 20-30 with pumice soils extending this to 40. Sulphur is usually more ubiquitous and whilst the amounts required are not as great as for P, it is often limiting in inland hill country. Sulphur can be measured in soil in both immediately (sulphate) and long-term (organic-S) plant-available forms.

Sheep & Beef system comparison

In 2003, ARGOS started a comparative study using 12 clusters of S&B farms with each containing matched Conventional, Integrated Management (IM) and Organic farms. These clusters were located throughout the South Island from Marlborough to Southland. IM can best be described as a production system where management follows a set of particular export protocols using aspects of both Conventional and Organic systems e.g. the use of tools such as integrated pest management are used to reduce the use of anthelmentics, antibiotics etc. Soil testing of the main landforms within each farm was carried out for a range of chemical, biological and physical properties to measure differences between systems now and into the future. Soil tests for P and S included Olsen-P, (NZ standard P soil test), Resin-P, (used where RPR is the main P fertiliser applied and we want to measure both immediately and slowly available P), Sulphate-S, (immediately available) and Organic-S (long-term supply).

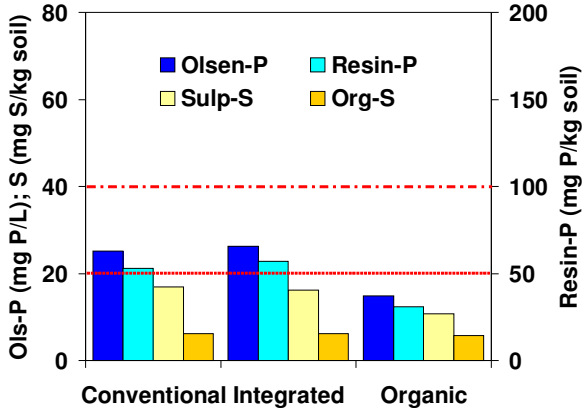
Of the three systems examined, Organic has the lowest external nutrient inputs so more careful attention needs to be paid to soil P and S test values. This is to ensure that they are maintained at levels that the competitive advantage of the legume/grass system is not lost or seriously impaired. In Organic systems P and S can still be added from external sources but must be either slowly-soluble or

slowly-reactive materials like reactive phosphate rock (RPR) or elemental sulphur.

Comparison of Sheep & Beef systems

Soil tests for Olsen-P show that the majority of Conventional and Integrated farms are within the optimal range (Figure 1) but Integrated had the highest number of farms exceeding the optimal range (55% Olsen-P >30) suggesting their pro-active management resulted in greater fertiliser use. High soil P values (>60) are of concern because farm runoff can contain both dissolved P and P-rich soil particles which, once in streams and rivers, can lead to poor water quality and algal blooms. Of the Organic farms, however, about 50% of P levels were below the optimal range (ie. Olsen-P less than 20). Tests for resin-P showed no additional available-P present in unreacted phosphate rock for any of the farm systems.

Fig. 1 Mean P and S soil test values for Conventional, Integrated and Organic systems for Sheep & Beef farms.

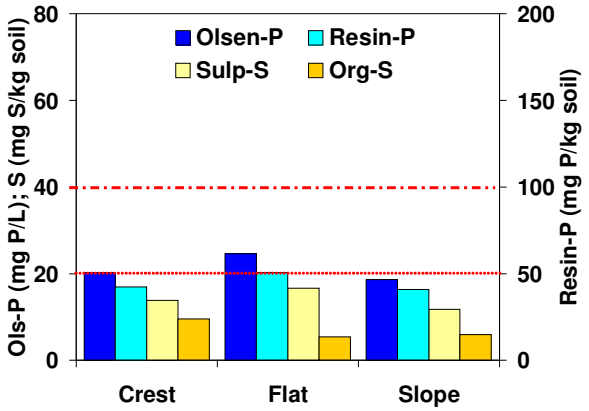


Sulphate-S values generally reflected similar differences between S&B systems as for P, although S is not usually of environmental concern. Organic-S was also marginally lower for Organic farms which may suggest that regular monitoring of both inorganic (sulphate) and organic-S would be wise to ensure S reserves don't become depleted over time. With less S being added in fertiliser means there is less incorporated in SOM so S should be applied in Organic farms in materials such as elemental S.

Nutrient distribution around paddocks

Sampling of each farm meant getting representative samples from each major landform. We split these into flats, slopes and crests (flatter areas above slopes). A major nutrient issue that arises in hill farms is that of excreta transfer. This affects all farm systems but particularly Organic farms where inputs are generally lower. Stock tend to camp on the flatter areas of hill farms overnight so that there is a transfer of nutrients from slope areas, where stock graze, to crest sites (Fig. 2). The resulting transfer can see soil test values for slope soils become depleted of P, S and other nutrients over time and this may affect Organic systems disproportionately more. Crest and flat sites on the other hand can become nutrient enriched so less fertilizer is required on these areas and/or their losses more easily replaced.

Fig. 2 Mean P and S soil test values for Crest, Flat and Slope Landforms for S&B.



Future work

We will continue to monitor these sites to see how nutrient status changes over time and how the influence of management affects each system's ability to be more sustainable and resilient to change. Observing how lower soil P and S values are affecting Organic farms will be of interest.

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