Northland Pastoral Extension: Popular Summary

Fertiliser Responses in Northland

NORTHLAND NATURALLY
FIRST REGION OF NEW ZEALAND

Sustainable Farming Fund

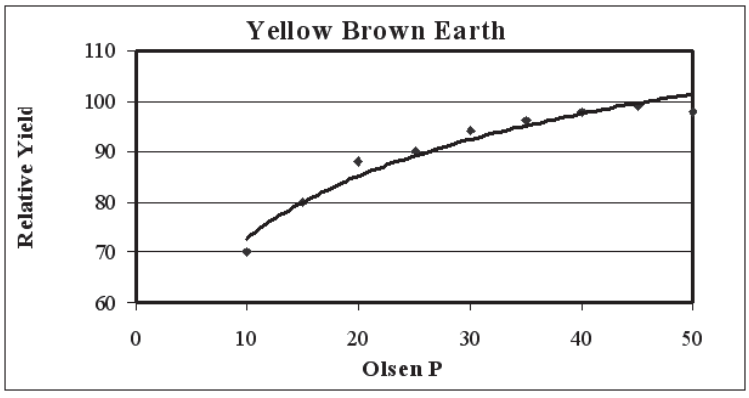
Summary of Key Findings

- Most soils in Northland in the undeveloped state are deficient in phosphorus, sulphur and some trace elements
- For development, phosphorus (P), sulphur (S) and lime are always needed. Potassium (K) deficiency develops over time. Molybdenum (Mo) is needed on most soils and copper (Cu) may be needed on the podzols.
- For most soils, annual maintenance fertiliser would be in the range of 25 to 50kg/ha of P.
- At Olsen P levels in the desired range or greater with the farm stocked at below the maximum possible there are "capital" reserves of P in the soil sufficient to prevent losses of production for up to two years if no fertiliser P is applied.
- Reactive Phosphate Rock (RPR) can be used for maintenance fertiliser, once P levels in the soil are sufficient.

Maintenance Fertiliser:

Phosphorus

The optimum levels for P in the soil are determined from pasture production response curves
These curves for the major Northland soil groups are based on data from grazing trials carried out in the 1980s, and a typical example is as follows.



In many farm situations it is not economical to farm at the optimum Olsen P level and it all depends on the efficiency of each property. The higher the financial returns are per ha the closer the economic optimum comes to the biological optimum. Each major soil group has its own response curve and from these the optimum P level can be given as follows where you are farming at the economic optimum.

Soil Group	Optimum Olsen P	Desired Range
YBE	25	20-25
RBL and BGC	30	25-30
YBS & Recent soils	25	20-25

Note: The optimum P level is that for 95% of maximum production.
Note: A desired range is given because soil test and field trials results are not precise measurements.

For most soil types the P status remains constant at annual application rates of P from 25-50kg/ha. However the actual amount needed depends on the farm type like sheep and beef or dairy and the intensity of grazing management within each farm enterprise.

Fertiliser Recommendations:

Fertiliser recommendations should be specific to each farm and developed in conjunction with your fertiliser advisor using soil and herbage tests. Research on Northland soils has helped derive some rough rules of thumb farmers can use to estimate approximate maintenance fertiliser requirements.

Rules of thumb

Dairy: A maintenance rate would be 100kg/ha of 20% potassic super for each 100kg of milksolids production from pasture. Presently the average milksolids production per ha on the milking area is about 650kg milksolids so the rule of thumb would suggest 650kg/ha of 20% potassic super, which is equivalent to about 50kg/ha of P and 65 kg/ha of K and 55 kg/ha of S.

Sheep & beef: 100kg/ha of superphosphate for each 100kg per ha of net carcass meat and wool production per ha. The average production level on Northland sheep and beef farms is about 250kg net carcass meat and wool per ha so 250kg/ha of superphosphate would be a maintenance level.

These figures are approximate guides; advances in soil fertility have led to development of computer programs which use individual farm information, such as supplementary feed, soil type and base fertility to more accurately define maintenance fertiliser requirements.

Changing the P Status

The trial work carried out in Northland has given some good indicators to the amount of P that needs to be applied to increase the soil test levels. The rates needed are clearly related to the phosphate retention levels. These rates are higher than figures typically used in national publications.

Soil Group	P (kg/ha) to lift Olsen P by one unit.	P Retention %
Yellow-brown earth, podzols	11	20-40
Yellow-brown sands, recent soils	20	30-40
Red-brown loam, brown clays	30	50-70

Fertiliser Recommendations:

Potassium is an important nutrient in Northland and is strongly associated with clover growth. The large variation in soil type and retention of potassium across Northland makes broad recommendations difficult. Recommendations should be based on discussion with your fertiliser advisor.

Molybdenum

About 20 years ago the recommendation was for Mo to be applied every three to five years depending on the soil type. This lead to an overuse of Mo and induced Copper deficiency problems on some farms. This, again, led to the non-use of Mo. The need for this trace element can be judged with clover herbage analysis and is an overlooked element in the improvement of pasture vigour.

Major test indicators

Soil (and herbage) test results are a valuable guide and can be used in when making fertiliser recommendations by people with some expertise in soil fertility and knowledge of the individual property. Optimum soil fertility varies from farm to farm and is related to the production objectives of each farm, typically higher producing farms will have higher optimum soil fertility targets. Note that P retention or ASC (Anion Storage Capacity) is a natural soil phenomenon and cannot be altered

Test	Very low	Low	Medium	High
Olsen P				
Yellow-brown earths	<10	10-20	21-25	>25
Brown clays/ R-B loams	<15	15-25	26-30	>30
Yellow-brown sands	<10	10-20	21-25	>25
P retention or ASC	0-30	31-60	61-90	>90
Quick test K				
Dairy	0-3	4-6	7-10	>10
Sheep & Beef	No data	0-4	5-8	>8
Sulphate S	<5	5-9	10-12	>12
Organic S	No data	5-9	10-12	>12

What happens when you stop?

When product prices are low, fertiliser may be sacrificed in favour of development work such as extra subdivision and access lanes, drainage, upgraded water supply, and building of yards or woolsheds. These are all items that would enhance the efficiency of production. The results from trials on hill country sheep and beef farms suggest that where Olsen P levels are 15 or greater, and the farm is stocked at below the maximum possible rate then there are sufficient "capital" reserves of P in the soil to prevent losses of production for up to two years if no fertiliser P is applied. On more intensive farming systems eg dairying, data and trials in the Waikato and Taranaki suggests a higher Olsen P than 15 would be needed to similarly prevent production losses but no trials have been done in Northland.

Reactive Phosphate Rock

Reactive phosphate rocks used in agriculture as fertilisers are those which without any treatment with acid are able to dissolve at least 30% of the total phosphate content with 2% citric acid. The main agronomic differences between RPR and superphosphate are the rates at which they release phosphate and the fact that superphosphate also contain about 10-11% sulphur while the RPR seldom contains more than 1% sulphur. The four main RPR's used in New Zealand are Arad, Egypt, North Carolina, and Sechura. They appear to be equally effective sources of phosphate but Sechura contains molybdenum as well.

The rate at which RPR's dissolve depends on soil conditions especially the acidity and soil moisture levels and on the particle size of the RPR material. During the late 1970s and 1980s there were a National series of trials, which compared the effectiveness of superphosphate and the RPR's over a period of 12 years. There were 19 sites and most trials lasted six years, five of these sites were in Northland. Most trials compared Sechura and North Carolina with triple super. Sulphur was applied to eliminate any possible deficiencies of that element. The trial results were put into two groups; those where adequate molybdenum was present and those, which may have been Mo deficient.

Results

- Between 30-40% of the RPR dissolved in the first year of application.
- By the third or fourth year the amount of phosphorus dissolved was equal to that of triple superphosphate.
- The RPR's dissolved more slowly on sites that were dry (less than 600mm rain) or had pH levels above 6.0 but few sites were in the grouping.
- Pasture production yields varied considerably from year to year and this variation often exceeded the differences in the response of the fertilisers used.

Recommendations

- RPR should not be used if pH greater than 6.0 or there is less than 800mm of rain.
- For capital applications of phosphate to lift the P level use a soluble phosphate.
- To maintain soil P levels either RPRs or soluble forms of phosphate can be used.
- If the Olsen P levels are high then a change to RPR products will show little decline in production and is likely to be less than the normal variation from year to year.

Liquid fertilisers versus solids

Many trials of liquid fertilisers have been conducted in Northland. When liquid fertilisers first came on the market in the late 1960s, claims were made that foliar applications would be five to eight times more efficient in delivering nutrients because phosphate utilisation by plants from solid fertiliser was low. Trials were set up to prove the contention that 75-90% of P was effectively used by pasture plants.

The treatments on high and medium phosphate-retentive soil compared a liquid product Liquiphos with solid fertilisers on an equal-cost and equal-nutrient basis. The trials showed that solid fertilisers applied at equivalent cost to liquid fertilisers were always superior in pasture production.

It is interesting to note that in some of these trials there was no response recorded due to the high base soil fertility level. This demonstrates the importance of testing new fertiliser products over a number of years on a number of sites. The benefit of any fertiliser product promoted on the basis of the results of a limited number of trials should be treated with caution.

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A project co-ordinated by the Northland Pastoral Farming Development Group.
The complete research stocktake on Fertiliser Responses in Northland is on the Enterprise Northland website: www.enterprisenorthland.co.nz