AMENDING THE SOIL:

FARMER EXPERIENCE IN THE USE OF SOIL ANALYSIS

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"Ardenside"
Tooma

THE PROPERTY

Ardenside Station is situated in the Upper Murray district of New South Wales 27 kms north west of Corryong and 45 kms south of Tumbarumba.

Ardenside covers an area of 5770 ha (14,259 acres). Of this, 607 ha (1,500 acres) are adjacent to 27,710 ha (66,000 acres) of high country forest lease. This area is principally used as a mustering lease for 1,900 head of cattle which graze the lease from mid December to June.

Annual rainfall averages 838 mm (33.5 inches) principally occurring in autumn, winter and spring.

Ardenside varies in altitude from 320 m to 700 m above sea level. The most dramatic change in elevation occurs in a block of Crown Land Lease which provides access to 3,160 hectares of freehold. The country could generally be described as undulating to hilly.

THE OPERATION

Cattle are the main enterprise. The property runs 1,460 angus cows and calves and 800 two and three year old heifer replacements. The calves are weaned in May-June with the steers going onto oats until they reach 300 to 320 kg. Within this weight range they are ready for our traditional buyers, bullock fatteners and feedlots. Heifers surplus to replacement requirements are sold to restockers. Approximately 4,000 sheep are run as a secondary enterprise.

HISTORY AND DEVELOPMENT

The property is best analysed in its three sections:

1. Ardenside - 2,004 ha, and 320 m above sea level.

2. Bogandyera - 2,282 ha, and 700 m above sea level.

3. Allerthorpe - 878 ha, and 550 m above sea level.

Approximately 85 years ago gangs of Chinese ringbarkers rung the native timber on all three sections of the property. Sadly, they were very efficient at their job and obviously had little appreciation of the problems which would occur in the future. Consequently there are few trees on Ardenside and Allerthorpe.

Regrowth was left unchecked in the Bogandyera and timber stands estimated to be 40 to 50 years old dominate the area.

PASTURE DEVELOPMENT

1. Ardenside and Allerthorpe

Pasture development has so far involved sowing down improved pasture on previously native pasture paddocks. This development occurs over a two year period.

Year 1: Paddock preparation involves pushing up remnants of rung timber with our own D6 bulldozer. The paddocks are then stickpicked to remove timber missed by the dozer. Fallowing occurs in October-November. Depending on location and drainage, either oats or Tetila ryegrass is sown on an autumn break.

Year 2: Stubbles are burnt during March-April. Grazing of self sown oats and germinated weeds carries on until May. A tank mix of knockdown and broadleaf herbicide is applied with a boom spray when conditions are suitable. Sowing of permanent pasture takes place with direct drill equipment.

Approximately 450 ha (1,100 acres) are in either of these phases annually.

2. Bogandyera

Pasture development has revolved around clearing timber and windrowing. Improved pasture from this stage takes two years.

Year 1: Fallowing between the windrows occurs in November-December in the same year as clearing using offset discs. Scarifying and harrowing take place in February with oats being sown as soon as conditions allow.

Year 2: Ploughing takes place in February. The windrows are burnt and stoked during April. The paddock is then scarified and harrowed and sown down to permanent pasture as soon as conditions allow.

Year 3: Sucker regrowth control with herbicide.

Approximately 420 ha (1,037 acres) are in either of these phases annually.

WHY DO WE ANALYSE THE SOIL?

We find the use of soil analysis important for the following reasons:-

1. Soil testing allows you to become more familiar with the most important resource on the farm.

2. Soil testing gives you the opportunity to plan ahead and rectify problems with the soil.

3. Soil testing gives us the opportunity to correct deficiences before sowing expensive pasture seed, eg. Mo, P.

4. There is the opportunity to select pasture species that will tolerate your soil chemistry and in doing so, reduce the chance of failure. Soil testing enables priorities to be set and creates the opportunity for more effective fertilizer use as operators tailor their programmes to measured parameters.

PLANNING

As with all programmes adequate planning of pasture improvement is necessary. Soil testing has to be carried out well before paddock preparation occurs. The time lapse between soil sampling and receiving the results is approximately two months.

If a particular problem is highlighted in the soil chemistry, a change in fertilizer may be necessary due to the recommendation. This can then be ordered will ahead of sowing. There are also occasions when the pasture mix may have to be changed to ensure success.

SOIL TESTING

Our soil testing to date has only involved Department of Agriculture personnel. The District Agronomist takes the soil samples using sampling augers at two depths, 0-7.5 cms for pH and phosphorus and 0-15 cms for pH and major elements. The soil samples are taken randomly across the paddock in an effort to give a true indication of the soil chemistry.

This method of sampling is questioned in some quarters as regard to error due to paddock variability. From our experience remedial action taken on the basis of these results has been well worth the effort.

Somewhere along the line farmers who wish to obtain any degree of continued success with their pasture establishment must have the soil tested.

SOIL TEST RESULTS

Soil test results come back in the form shown in Figure 1. The left hand column gives the optimum range of parameters measured. There is also an explanation of the effects of divergences from these optimum ranges and plant species tolerances to elements found to be in either toxic or deficient supply.

INTERPRETATION AND REMEDIAL ACTION

Soil testing on Ardenside has shown our average pH to be 4.4 ($CaCl_2$). Considering the optimum pH range, our soil is described as highly acidic. We can, therefore, take two options:-

1. Select pasture species which can tolerate our pH, or

2. Use lime to reduce the acidity of the soil. The cost of applying bulk lime on the areas involved has encouraged us to seek a cheaper alternative. This alternative has been the use of 50:50 lime and super applied at 247 kg/ha, which is the maximum quantity we can get through our machines. Phalaris response to this treatment has been fantastic.

Lime has been predominantly used where low pH has co-existed with high levels of toxic aluminium. This has been beneficial in the successful establishment of phalaris and Redquin clover.

Molybdenum deficiency is a problem in soils with a low pH. The use of double super at sowing in an effort to reduce freight and handling costs does not give us the opportunity to overcome this.

Figure 1

NEW SOUTH WALES GOVERNMENT

MR M. MANSFIELD

DEPARTMENT OF AGRICULTURE

SOIL TEST RESULT SHEET

OPTIMUM RANGE	YOUR SOIL TEST RESULTS PADDOCK IDENTIFICATION:			
	SOUTH BYLANDS PADDOCK	ARMLEY PADDOCK	MALHAM PADDOCK	
Soil pH (acidity or alkalinity) pH 5.2 - pH 8.0 ($CaCl_2$) Depending upon species, satisfactory growth is possible in this range. At lower pH's aluminium and manganese may be toxic and molybdenum deficient. At higher pH's certain trace elements may be deficient	4.8	4.8	4.4	
CONDUCTIVITY (measure of salt content) less than 0.2 mS/cm on sandy soils less than 0.4 mS/cm on clay loam less than 0.7 mS/cm on clay soils	0.14	0.14	0.09	
PHOSPHORUS (Bray No. 1) 15-25 ppm.	7	42	18	
CATION EXCHANGE CAPACITY (C.E.C.) 4 m.e./100 g or higher	3.6	6.1	5.4	
EXCHANGEABLE CATIONS				
Calcium 65-80% of C.E.C.	55.2	75.7	67.2	
Magnesium 10-15% of C.E.C.	18.0	12.5	12.4	
Potassium 1-5% of C.E.C.	11.3	10.2	12.8	
Sodium 0-15% of C.E.C.	2.3	0.6	0.9	
ALUMINIUM 0-15% Depending upon species grown: 0-2% lucerne, medics. 2-5% red clover, phalaris/wheat, barley, rape. 5-10% subclover, ryegrass/wheat, lupins, turnips. 10-15% white clover, cocksfoot fescue/oats, rye, triticale.	13.2	1.0	6.7	
MAGNESIUM:POTASH RATIO 2:1 - 4:1 Wide divergences are acceptable with no ill effects in sensitive species.	1.6:1	1.2:1	1.1:1	
CALCIUM:MAGNESIUM RATIO 1:1 - 6:1 Wide divergences from this ratio have no ill effects.	3.1:1	6.1:1	5.4:1	

Clover seeds in the pasture mix are coated with molybdenum trioxide (as well as inoculant and lime). This has promoted vigorous clover growth which has been especially evident in the development country where a build up of soil nitrogen is paramount to the productivity of grass in the sward. Molybdenum is then applied when topdressing pasture (Mo super; .05%). We only use Mo super every four years with normal super being applied in other years.

COMPONENTS OF SOIL TESTS

(a) Conductivity - presents no problems in our soils.

(b) Phosphorus - phosphorus levels on the property range from 4 ppm to 42 ppm and average 18 ppm. Phosphorus is important in assisting early development of pasture seedlings and subsequent pasture productivity. Phosphorus also increases and improves the rate of plant establishment. Once in solution phosphorus does not move either laterally or vertically in the soil profile.

Soil testing highlighted a need for heavier rates of fertilizer in some areas and has allowed us to increase plant establishment and increase early productivity.

In Bogandyera and at Allerthorpe phosphorus levels range from 4 ppm to 26 ppm and average 11 ppm. From soil testing information the use of heavier rates of double super and/or Starter fertilizer has increased productivity.

An Example
The first oat crop between the windrows in the Bogandyera was sown without soil testing prior to sowing.

The crop was sown with double super at 62 kg/ha. The plants showed little vigour and grazing was not possible until spring. After soil testing that summer our phosphorus levels were shown to be 8 ppm.

The following oat crop sown between the windrows of the land cleared the previous year was sown with double super at 124 kg/ha. Grazing was possible during winter and the paddock carried 7 DSE/ha.

(c) Cation Exchange Capacity - Is a measure of the inherent soil fertility. The C.E.C. has a strong relationship to the parent material as shown below.

Slates - have a generally low C.E.C.;
Granites - have a medium C.E.C.;
Alluvials and Basalts - have a high C.E.C.

(d) Calcium - Generally found to be average to low in our area. Where levels are low 50:50 lime and super or bulk lime can be applied.

(e) Magnesium - Well supplied

(f) Potassium - Well supplied. Monitor paddocks which are continually cut for hay.

(g) Sodium - The lower the level the better. Sodium levels are very low in all paddocks on the property.

(h) Aluminium - Levels of aluminium appear to depend on the extent of the acid soil problem and past super application. Aluminium, reduces the establishment of certain species if excessively high.

Aluminium levels on the property range from 4.3% to 23.5%. When these levels are compared to the tolerance level of certain species in the optimum range it is obvious that aluminium is a problem.

To ensure reasonable establishment, particularly of phalaris which is one of our major grasses, 50:50 lime and super has been applied.

(i) Magnesium:Potash Ratio - Within acceptable range.

(j) Calcium:Magnesium Ratio - Within acceptable range.

CONCLUSION

Soil testing has been an invaluable tool in the successful establishment of pasture on Ardenside. In the past we have had reasonable establishment of species, but have been disappointed with early productivity and vigour. Soil testing has highlighted the major problem of traditional fertilizer application rates having not provided enough phosphorus to overcome the low inherent phosphate levels in our soil type.

Where phosphorus levels have been more than acceptable we have applied maintenance rates of superphosphate every second or third year. This has given us the opportunity to direct our fertilizer dollars into areas where phosphorus levels are lower and greater response will be achieved.

Super takes one of the largest slices of most farm budgets. Knowing your soil chemistry can allow a fertilizer budget to be tailored to total expenditure and enables identification of areas of your property with greatest response.

Future super programmes can be planned ahead with the opportunity to rectify problems before they arise. It must be remembered that soil testing is not black and white, but when used in association with personal knowledge, e.g. stocking rates, botanical composition and stock performance, it forms the basis of an overall farm operation programme.

Soil testing can reduce the possibility of failure as THE MOST EXPENSIVE PASTURE IS THAT OF A FAILURE!!!