Soil Acidification

Soils acidify naturally as they weather over thousands of years. The acidity of any soil varies according to the type of rock it comes from, the length of time it has weathered, and the local climate. Hence, some soils are naturally acidic while others are more alkaline. Agricultural practices can greatly increase the rate of acidification.

Causes:

- **Leaching of nitrate nitrogen**

Nitrate nitrogen is the form of nitrogen used by plants. It is either produced in the soil by the breakdown of organic matter, supplied as nitrate fertiliser or produced chemically from ammonium type fertilisers. If there is more nitrate nitrogen than the plant can use, it drains away (leaches) into the ground water system, leaving the soil permanently more acid.

- **Build up of organic matter**

Over the last 50 years use of fertiliser and improved pastures, has increased the amount of organic matter in the sod by up to 400%. While organic matter improves soil structure, it also makes the 0 1 sod more acid. It will not build up indefinitely, and when a new equilibrium is reached where the build up balances the breakdown, the acidification process stops.

- **Removal of produce**

Grain and pasture are slightly alkaline so their removal from a paddock leaves the soil slightly more acid.

What happens

- If soil pH is above 5.5, there is little immediate risk of acidity.
- Between pH5 and pH5.5 there is a risk to crops/pastures that are sensitive to acid soil.
- Below pH5 you can see the effects of acidity in the more sensitive crops and pastures with lower yields.
- Once the subsoil is acid only the more acid tolerant plants such as oats, triticale, subclover and cocksfoot can be economically grown. Subsoil (B horizon) acidity means permanent soil degradation, and a massive problem.

Management strategies

- apply lime in regular maintenance doses.
- grow deep-rooted summer growing perennial plants
- use lower rates of less acidifying fertilisers
- do not fallow cropping areas over summer
- retain stubble
- sow crops as soon as possible after the first rain
- encourage maximum growth by using acid tolerant plants.

Source: Agnote 5/113

BENEFITS FROM TREATING SOIL ACIDITY

Surface and subsurface soil acidity are major problems reducing crop and pasture yields in this region.

In crops

- more uniform plant growth
- more tillers (shoots) per plant
- higher yield especially with sensitive plants such as barley and canola

In pastures

- good root nodulation and vigourous early growth of clover
- better establishment and persistence of recently sown phalaris
- good growth in all plants

You will also avoid considerable yield loss in the future by minimising further surface acidification and preventing subsoils from acidifying. Your first step is to identify if you have acidity problems.

IDENTIFYING SOIL ACIDITY

Damage in crops or pastures can indicate acidity problems

- Poor early growth, patchy or uneven stands of clover and other legumes.
- Poor root modulation (low pH affecting the rhizobia)
- Short, stubby ineffective roots (aluminium toxicity)
- Yellowing and dead tips and edges of leaves (manganese toxicity)
- Poor establishment and persistence of recently sown phalaris
- Unexplained yield loss

SOIL ACIDITY

Soil acidity is a chemical condition of the soil reducing crop and pasture yields. It is commonly measured on the pH scale. Strongly acid soils have pH in water below 5.5 or pH in calcium chloride (CaCI 2) below 4.5. Problems associated with soil acidity include:

- Low pH can prevent legumes from nodulating and helpful soil micro-organisms from recycling nutrients.
- Low pH causes aluminium (AI) to be released from the soil. This available aluminium is toxic to plants and micro-organisms
- Low pH in soils combined with hot dry conditions (Autumn after a dry summer) or in warm poorly drained soils (wet Spring) may cause toxic levels of manganese (Mn) in the soil solution.
- Available aluminium can tie-up valuable phosphorous (P), and low pH can cause trace element problems such as molybdenum (Mo) deficiency.
- Decreases in pH may cause increased cadmium (Cd) uptake by crops and pastures. Cd levels can then reach harmful levels in the kidneys and liver of grazing stock more than 2 or 3 year old.

Acidic soils may have some or all of these problems. The most serious problems for soils in this region are toxic aluminium, toxic manganese and low pH. For each soil it might be a different one of the three problems which is most important. Each crop or pasture may be most affected by a different aspect of soil acidity.

Surface acidity

Soil acidity within the ploughed layer (roughly 0-10cm depth).

Subsurface acidity
Soil acidity below the plough layer (10 cm to 30 or 40 cm depth). Subsurface acidity can have as much effect in reducing yield as surface acidity but it is much more difficult and costly to correct.

Based on: “Benefits from identifying and treating acid soils” National Soil Conservation Program