

Soil Management for Grassland

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Grass and Animal Nutrition from the Soil



Macro

- **NITROGEN**
- **PHOSPHATE**
- **POTASSIUM (Potash)**
- **SULPHUR**
- **CALCIUM**
- **MAGNESIUM**

Micro

- **CHLORIDE**
- **BORON**
- **IRON**
- **MANGANESE**
- **COPPER**
- **ZINC**
- **COBALT**
- **MOLYBDENUM**

Sodium, Iodine , Selenium :
specifically for animal nutrition

Soil Nutrients



There are 13 nutrients that are essential for plant growth.

However, for grassland production the ones that need to keep track of :-

NITROGEN
PHOSPHATE
POTASSIUM
SULPHUR

For animal nutrition :-
MAGNESIUM

Nitrogen



N

- Nitrogen is needed for almost every plant process. It forms amino acids, proteins, chlorophyll.
- The reserves of N in soil are actually very high : between 4,000 and 5,000 kg/ha (3,200 to 4,000 units/acre)
- Most of this is locked up in the soil organic matter.
- It is released to the grass through bacterial activity---which is both temperature dependent and pH dependent.
- Between 1 and 2% can be released per annum 40 to 100 kg/ha (32 to 80 units/acre)

Phosphorus



P

- Phosphorus (phosphate) is needed for plant cell division. It also provides energy reserves.
- Very important for root development
- Uptake by grass is temperature dependent. Deficiency most likely to be seen in spring when soil temperatures remain low.
- Soil tests are good predictors of availability

Potassium



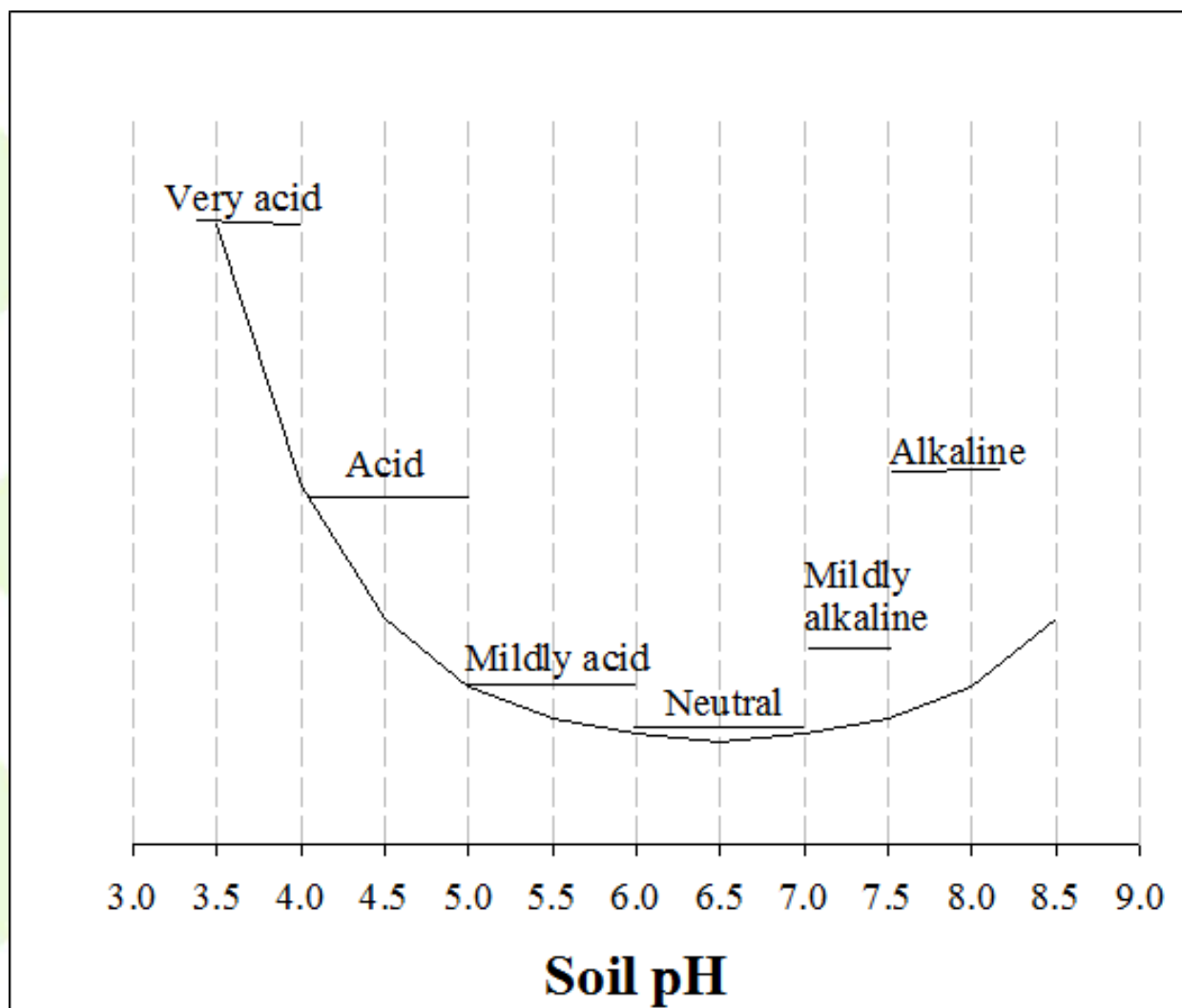
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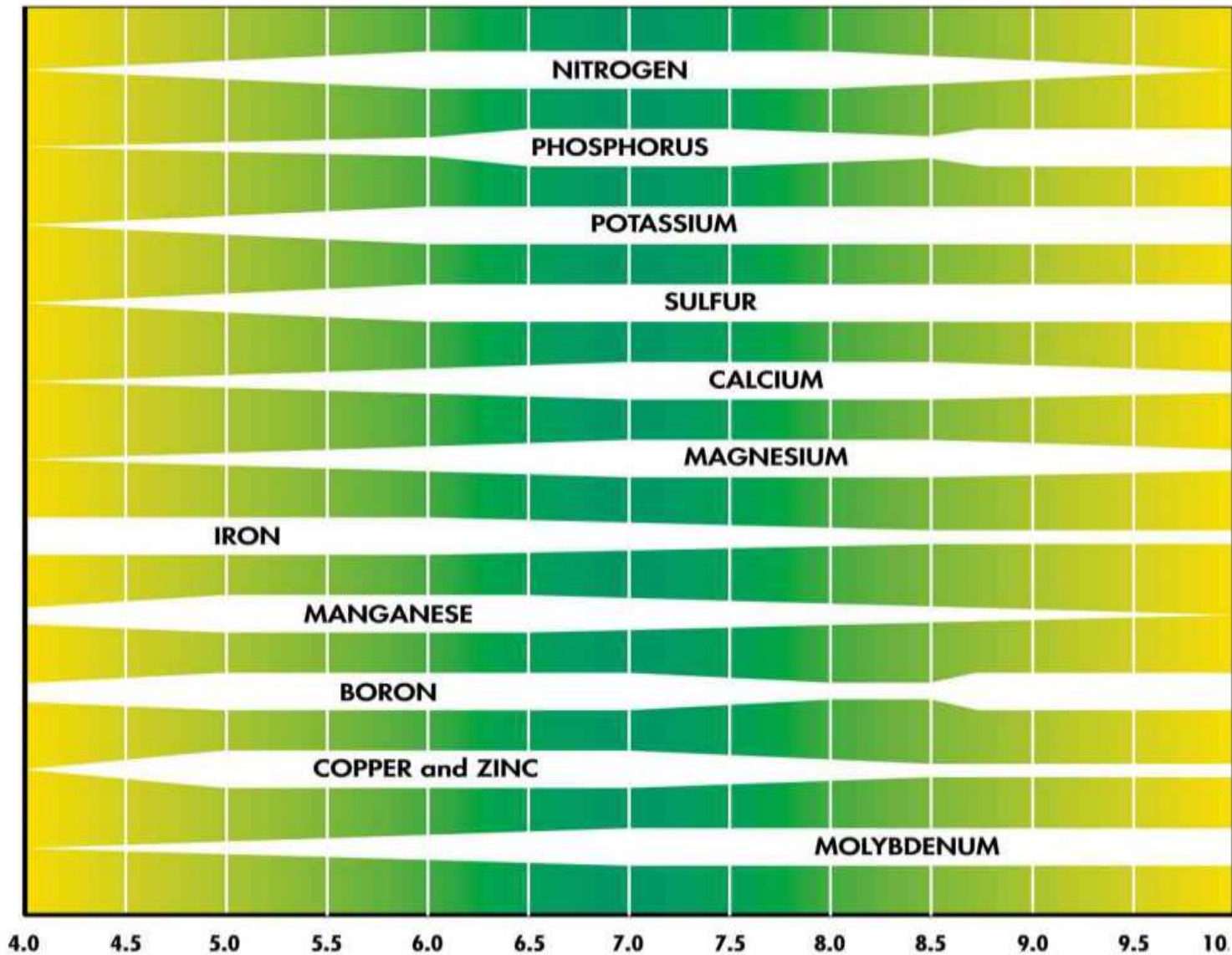
- Potassium (potash) is needed for carbohydrate production in the plant.
- It is also important for drought tolerance
- It tends to be fairly mobile; it can even be washed out of the grass leaf.
- Soil tests are good predictors of availability

S

- Sulphur is needed for amino acid and proteins.
- Deficiency symptoms tend to be similar to nitrogen – general lack of growth.
- If growth is poor after application of N fertiliser, then the cause could be S deficiency
- Leaf tests are used to determine availability

Soil pH





Soil pH



The acidity of soil has a major impact on grass growth.

The trend is normally towards acidity due to rainfall (pH 5.5) and fertiliser application :

For example:- The following fertiliser products applied over a 5 year period would need the amount of lime shown to return to original pH

FERTILISER	Total applied cwt/acre	Lime required cwt/acre	Total applied kg/ha	Lime required kg/ha
34.5-0-0	10	6.2	1250	780
25-5-5	10	4.4	1250	550
16-16-16	10	2.9	1250	360
8-24-24	10	1.4	1250	170

- A number of trials have shown that :-

Raise soil pH from 4.5 to 6.0 →
increases herbage production from 6 to 9 tonnes DM /ha per year

(Approximately every 0.1 pH unit → 200 kg DM/ha increase)

To increase soil pH from 4.5 to 6.0 would require approx. 5 Tonnes of lime per ha,
To increase herbage production from 6 to 9 tonnes DM/ha per year would require 100kg Nitrogen/ha per year.

Raising soil pH



Various liming materials :-

- Limestone (Calcium carbonate)
- Dolomitic limestone (Magnesium carbonate)
- Burnt lime (Calcium oxide)
- Slaked lime (Calcium hydroxide)

- Other by-products eg ground scallop shell waste

Their effectiveness assessed by neutralising value, but particle size is also important.

Application of nitrate fertiliser also raises pH

Soil structure



Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.



Blocky: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.



Prismatic: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.



Columnar: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.



Platy: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.



Single Grained: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.

- Grass growth will be severely affected by soil compaction, both at surface and depth.
- **Surface compaction** (0 -10 cm) Root growth restricted by lack of oxygen.
- **Machinery compaction** (10-15cm) Root growth physically restricted
- **Plough pan** (>15 cm) Poor drainage affects root growth

Poor drainage

Long term effects of poor drainage :

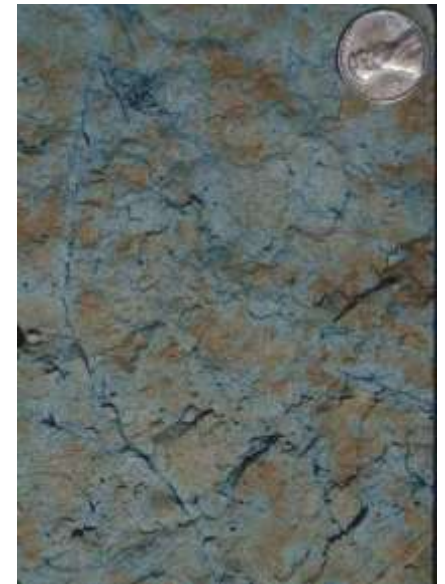
- A wet soil takes longer to warm up in spring
- Poor breakdown of organic matter by earthworms and soil microbes with accumulation of organic layer, especially if soil is acidic.



Poor drainage

Long term effects of poor drainage :

- Nitrogen is lost by nitrous oxide gas
- Anaerobic conditions cause accumulation of toxic gases eg hydrogen sulphide.



Soil structure

- Surface compaction can be alleviated by spiking or chain harrow
- Machinery compaction alleviated by sward lifter
- Plough pan by subsoiler, mole ploughing



Soil structure



- On – going maintenance can improve soil structure :-

Liming and application of organic materials will help structural stability.
These will also encourage earthworm activity

- Perhaps even the grass mixture, forage crop will help in improving soil structure -----

Soil structure

- Grassland type may have an effect :-
- Trial established (*Wageningen University*) Spring 2004

December 2005	Root biomass g/m ² 0 -10 cm	Earthworm Number/m ² (0 to 20cm depth)	Earthworm Burrows/m ² (10 cm depth)
Grass only	218	326	67
Grass /clover	193	359	138
Clover only	73	480	225



The Root of the Matter



It is inevitable that root growth is often forgotten about.

However, all plant nutrients are derived from the root system; and, like the grass leaves, the roots need air-----

So any maintenance to help root growth will have a major impact on grass growth.



Any Questions?