

## Forage Mineral and Trace elements on PROSOIL farms

Farms in the PROSOIL project have been monitoring the mineral and trace element levels in forage as part of the study into the effect of different soil management practices on soil health.

Mineral and trace element analyses of forage provide a farm specific “snapshot” of levels which can inform investigations into mineral and trace element deficiency in livestock. Deficiency in stock is most accurately diagnosed by blood and tissue analysis.

Fifteen mineral and trace elements are essential to animal production, with minerals like calcium and phosphorous needed in relatively large amounts; trace elements like Manganese (Mn), Zinc (Zn), Selenium (Se), Copper (Cu), Cobalt (Co) and Iodine (I) are equally important but needed in much smaller quantities.

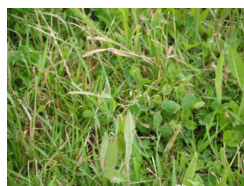
Individual forage species have a different mineral and trace element profile. Red and white clover and chicory contain more minerals and trace elements than perennial ryegrass (see fig 1.)

**Fig 1. Mineral content of forages.**

Species	Chicory	PRG	Red Clover	White Clover	Species	Chicory	PRG	Red Clover	White Clover
<b>% content</b>					<b>mg/kgDM</b>				
Calcium	1.3	0.8	1.8	1.6	Manganese	100	109	75	63
Phosphorus	0.3	0.26	0.27	0.35	Zinc	114	35	56	32
Magnesium	0.4	0.23	0.4	0.27	Selenium	0.36	0.02	0.03	0.02
Potassium	1.7	0.99	1.14	1.29	Copper	13.5	6	12	9.2
Sodium	0.34	0.42	0.23	0.33	Cobalt	0.09	0.04	0.07	0.05
Sulphur	0.19	0.16	0.16	0.19	Iodine	0.34	0.23	0.26	0.31

**Source:** Mineral content of chicory compared to perennial ryegrass, red clover or white clover over two harvest years: Marley C.L *et al.* (2013)

### Case study: Minerals and trace elements in a multispecies sward at Bryngido farm



Bryngido, a beef and sheep farm near Llanarth in Ceredigion, run by Rhodri and Anwen Hughes established ryegrass and multispecies leys as part of the PROSOIL project. The multispecies ley contained ryegrass, 4 different clovers and a range of pasture species including sainfoin, chicory, yarrow, and plantain. Sward yield and root depth were measured and trace element levels were analysed in the spring and autumn.

### Results.

- Levels of the majority of minerals and trace elements tested in both swards were within the typical range for UK pastures 2 years after establishment however the ryegrass sward contained higher levels of potassium and sulphur and lower levels of zinc than typical pastures
- The multispecies ley contained higher levels of sulphur and manganese than typical pastures
- There was seasonal variation in mineral and trace element content:
  - levels were higher in the autumn than in the spring
  - the multi species ley tended to have higher levels than the ryegrass ley in the autumn
- The multi species ley was higher yielding and deeper rooting than the ryegrass ley over 3 harvest years



**Fig 2. Minerals and trace elements in Bryngido herbage with typical ranges for UK pasture (per kgDM)**

	Typical range in UK swards	Bryngido range ( <b>ryegrass</b> )	Bryngido range ( <b>multi species</b> )
Calcium %	0.5-0.7	0.7	0.7
Phosphorus %	0.3-0.4	0.4	0.4
Magnesium %	0.15-0.25	0.22	0.22
Potassium %	1 to 3	3.4	3.0
Sulphur %	0.15-0.25	0.27	0.26
Manganese mg/kg	75-125	101.8	162.3
Zinc mg/kg	40-80	34.6	44.0
Selenium mg/kg	0.1-0.2	0.1	0.1
Copper mg/kg	8 to 12	8.8	9.4
Cobalt mg/kg	0.2 - 0.3	0.2	0.3
Iodine mg/kg	0.5 – 1.5	1.2	1.4

## Summary

Diverse multispecies leys can be used to help modify the mineral and trace element content of sward. They offer a natural way to manipulate levels and have a role to play when livestock depend upon forage as the main source of minerals and trace elements in their diet. In the PROSOIL project leys were able to support healthy productive livestock and stock appeared to prefer to graze the diverse ley compared to ley containing ryegrass only. Over 3 years the multi species ley at Bryngido was higher yielding and deeper rooting. On-going work in the project will investigate the effects a multispecies ley has on soil structure and function.

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