

Soil pH matters – the rising of the pHoenix

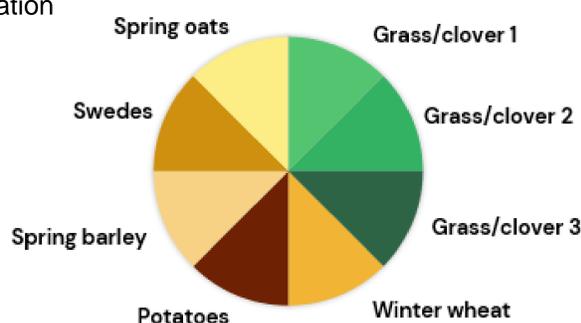
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Introduction

- Optimum pH for grasslands is 6.0 and for arable 6.2
- Only 1/3rd Scottish soils between 5.8 and 6.2 (Dolan et al, 2019)
- pH limits availability of nutrients
 - phosphorus uptake highest between 6 & 7.5
 - potassium uptake highest above soil pH of 6
- Poor soil pH leads to
 - Reduced yields, diffuse pollution and increased N₂O emissions

Methods

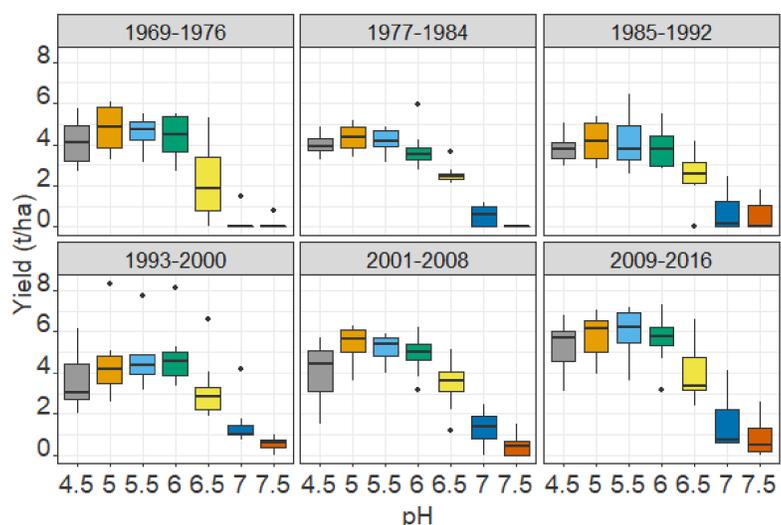
- Trial established in 1961 in North Scotland to demonstrate impact on yield to farmers
- 8 course ley / arable rotation



- Yields measured every year
- Soils health assessed for Grass/clover 2, winter wheat, potatoes spring oats in 2018

Results

- Spring oats yields – tolerant of low pH but not tolerant of high pH



Spring oats yields per cycle - Box and whisker plots show median, min, max and interquartile range



- pH had no effect on SOM%
 - Lowest in oats before the ley phase
- Ext. P lowest for pH 6 & 6.5
 - Greater uptake due to higher yields
- Ext K increasing with increasing pH
- Earthworms are very low at pH 4.5
 - Lowest in the potato phase



Attribute	pH 4.5	pH 6	pH 6.5	pH 7.5
pH	4.9	6.1	6.6	7.5
SOM (%)	10.3	10.1	10.3	10.3
Ext. P (mg/l)*	22	11	10	15
Ext. K (mg/l)	127	130	146	154
Ext. Mg (mg/l)	18	74	106	121
VESS	2	1	2	1
Earthworms (number/pit)	1	5	5	6

Investigate Monitor No action required

- modified Morgan P
- Soil Health Scorecard for pH plots averaged across 4 crop types
 Source: [TestingTheLongTermEffectOfpH2965_190918_WEB.pdf](#) (windows.net)

Future – Joint venture with Aberdeen University

- New Resources
 - “old soil” and “new soil”
 - Randomised plots
 - Beds will be planted with crops in spring 2023
- Opportunities for collaboration



Woodlands pH Soil	Bed 8	Bed 7	Bed 6	Bed 5	Bed 4	Bed 3	Bed 2	Bed 1
pH 4.5	106 pH7.0, 99 pH7.0	92 pH5.5, 85 pH5.5	78 pH7.5, 71 pH7.5	64 pH6.5, 57 pH6.5	50 pH6.0, 43 pH6.0	36 pH7.0, 29 pH7.0	22 pH7.5, 15 pH7.5	8 pH5.5, 1 pH5.5
pH 5.0	107 pH6.5, 100 pH6.5	93 pH5.0, 86 pH5.0	79 pH4.5, 72 pH4.5	65 pH7.5, 58 pH7.5	51 pH7.0, 44 pH7.0	37 pH4.5, 30 pH4.5	23 pH5.0, 16 pH5.0	9 pH4.5, 2 pH4.5
pH 5.5	108 pH7.5, 101 pH7.5	94 pH7.5, 87 pH7.5	80 pH5.5, 73 pH5.5	66 pH7.0, 59 pH7.0	52 pH5.5, 45 pH5.5	38 pH5.5, 31 pH5.5	24 pH6.0, 17 pH6.0	10 pH6.5, 3 pH6.5
pH 6.0	109 pH4.5, 102 pH4.5	95 pH6.0, 88 pH6.0	81 pH5.0, 74 pH5.0	67 pH4.5, 60 pH4.5	53 pH4.5, 46 pH4.5	39 pH6.0, 32 pH6.0	25 pH5.5, 18 pH5.5	11 pH7.0, 4 pH7.0
pH 6.5	110 pH6.0, 103 pH6.0	96 pH6.5, 89 pH6.5	82 pH6.5, 75 pH6.5	68 pH5.0, 61 pH5.0	54 pH6.5, 47 pH6.5	40 pH6.5, 33 pH6.5	26 pH4.5, 19 pH4.5	12 pH5.0, 5 pH5.0
pH 7.0	111 pH5.0, 104 pH5.0	97 pH4.5, 90 pH4.5	83 pH7.0, 76 pH7.0	69 pH5.5, 62 pH5.5	55 pH7.5, 48 pH7.5	41 pH7.5, 34 pH7.5	27 pH6.5, 20 pH6.5	13 pH7.5, 6 pH7.5
pH 7.5	112 pH3.5, 105 pH3.5	98 pH7.0, 91 pH7.0	84 pH6.0, 77 pH6.0	70 pH6.0, 63 pH6.0	56 pH5.0, 49 pH5.0	42 pH5.0, 35 pH5.0	28 pH7.0, 21 pH7.0	14 pH6.0, 7 pH6.0

Acknowledgements

The soil health scorecard was produced as part of the AHDB-BBRO Soil Biology and Soil Health partnership (ahdb.org.uk/greatsoils). The Scottish Government Strategic Research Programme

References

Dolan et al (2019) A Report on Soil and Organic Materials Analysis from the Soil and Nutrient Network Farms 2016 – 2018