# Woodlands pH Rotation plots - SRUC Craibstone

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(video link: https://vimeo.com/242280854)

## The Woodlands pH experiment


## Background

Management of soil pH is a crucial part of a successful cropping system. pH has a huge impact on nutrient availability and mineralisation of organic matter through microbial processes, both of which impact on crop growth and yield, rooting behaviour, production of biomass residues and consequently soil organic matter.

The Woodlands pH Rotation, located at SRUC Aberdeen (Craibstone) which was started in 1961 is an excellent demonstration of this.

Every winter, pre-ploughing, the soils have their pH tested and are adjusted through liming (to raise the pH) and with ferric sulphate (to lower the pH). The soil is a sandy loam, Countesswells Association, Dess Series, with soil organic matter of approximately 8%.

## The pH treatments and cropping sequence

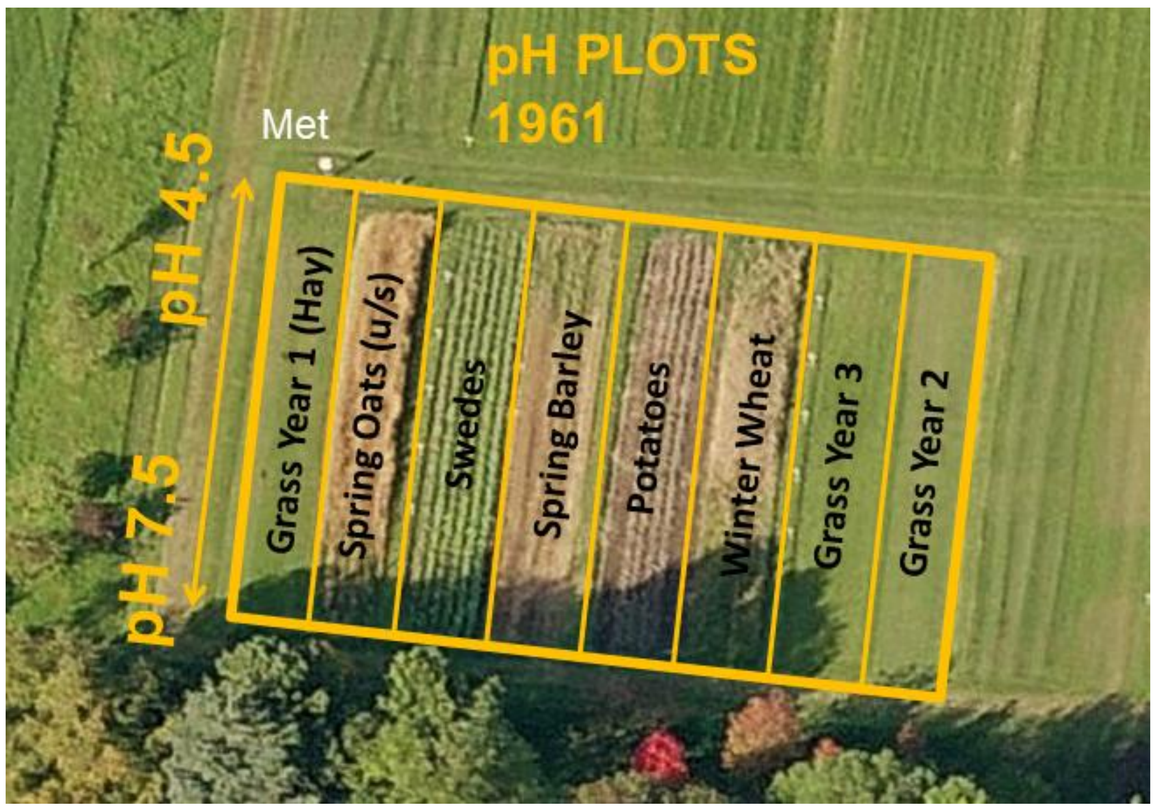
- Soils have had their pH modified since the start of the experiment (relatively settled!)
  - pH target range of 4.5 to 7.5 in 0.5 increments (7 plots)
- 8 course rotation, all crops grown each year
  - 3 years grass / white clover; winter wheat; potatoes, spring barley, swedes, spring oats undersown
  - The crops move to the adjacent
- Crops have **moderate** NPK fertiliser applications and pest, weed and disease control

## Table 1: Fertiliser inputs

| Crop | kg N/ha | kg P/ha | | kg K/ha | |
|---|---|---|---|---|---|
| Spring oats | 60 | 22 | (50) | 58 | (70) |
| Swedes | 70 | 35 | (80) | 83 | (100) |
| Spring barley | 90 | 22 | (50) | 58 | (70) |
| Potatoes | 100 | 66 | (150) | 100 | (120) |
| Winter wheat | 100 | 28 | (65) | 71 | (85) |
| Grass 3 | 0 | 0 | | 0 | |
| Grass 2 | 0 | 0 | | 0 | |
| Grass 1 (Hay) | 70 | 13 | (30) | 42 | (50) |

Values in brackets are $P_2O_5$ and $K_2O$

## Layout of the crops in the rotation (2017)




## Acknowledgements

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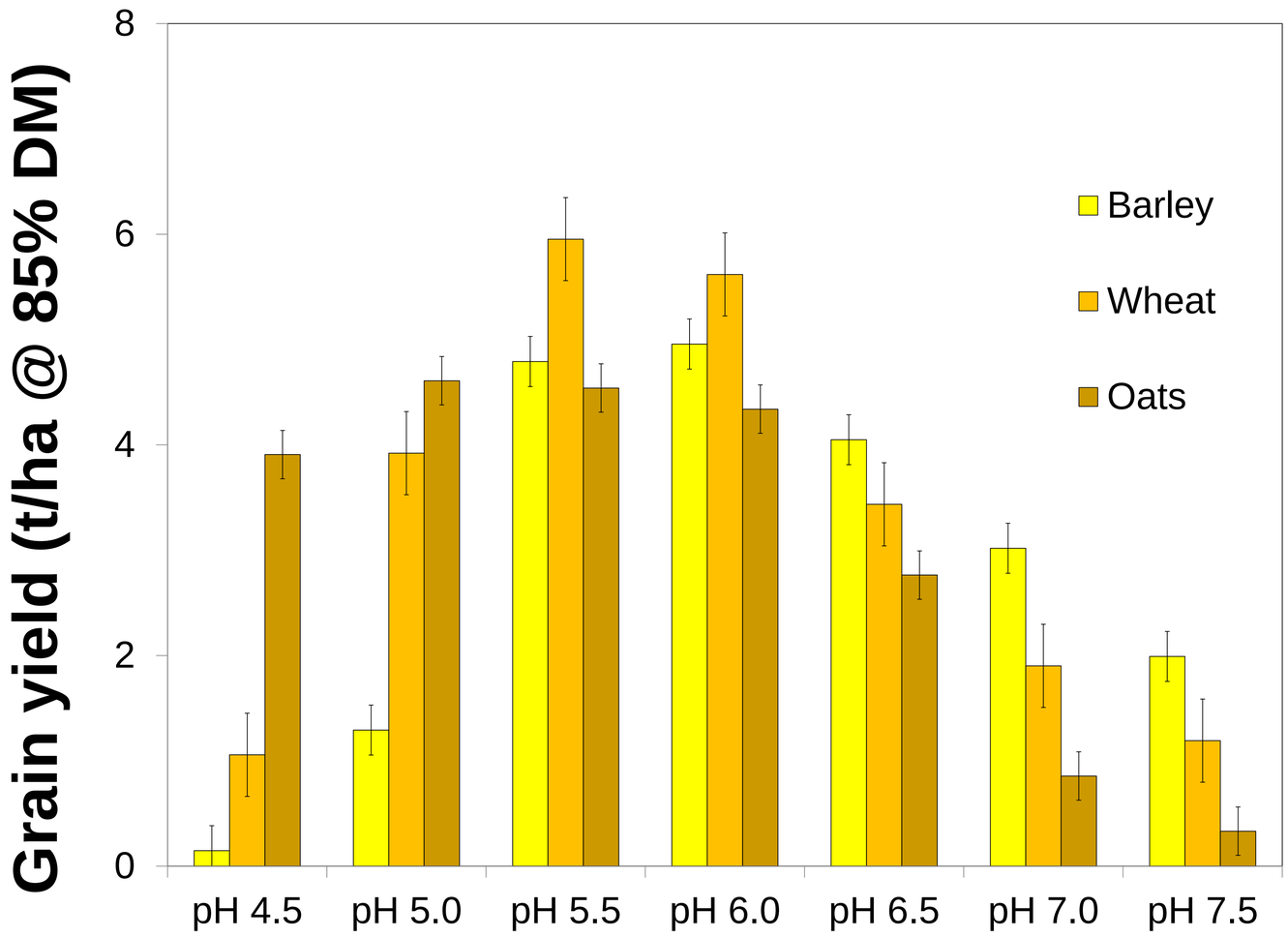
# Cereal Crops (48 year average)




**Spring Barley -** The soil pH has a massive impact on barley production at lower soil pH, with yields only starting to come good from pH5.5 upwards …. This is primarily due to lower soil pH inducing aluminium toxicity in the barley crop.

**Winter Wheat -** There is clearly a major impact of soil pH on the production of wheat grain, with production peaking at around pH5.5 to 6.0 in this experiment, but dropping off significantly at the pH extremes.

**Spring Oats -** Spring oats are able to tolerate quite low soil pH, and can yield relatively well even at pH 4.5 …. However, in this experiment, they do struggle to produce good yields when soil pH reaches 6.5 and above, primarily due to manganese deficiency.

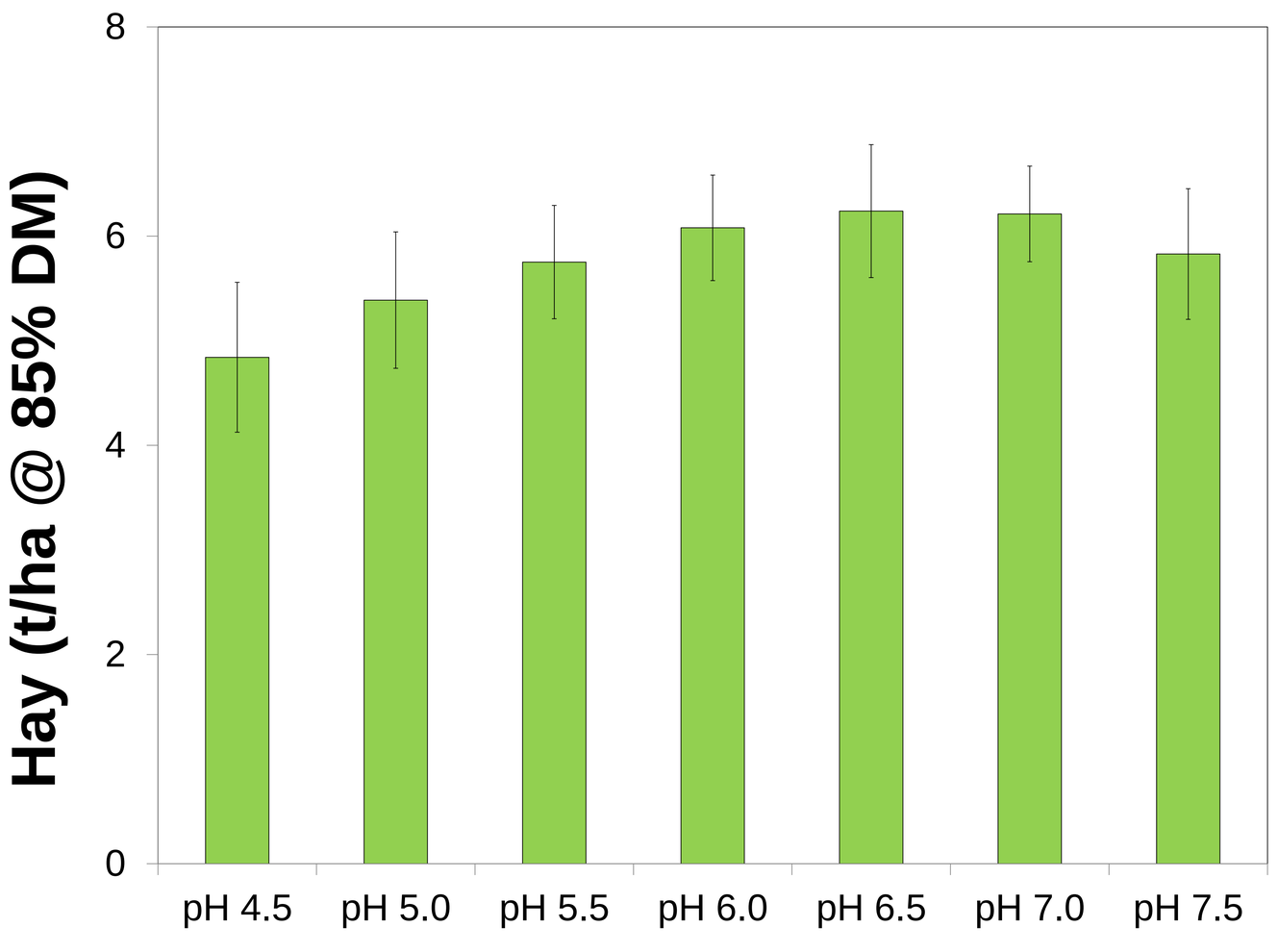
**pH 4.5** **pH 6.0** **pH 7.5**

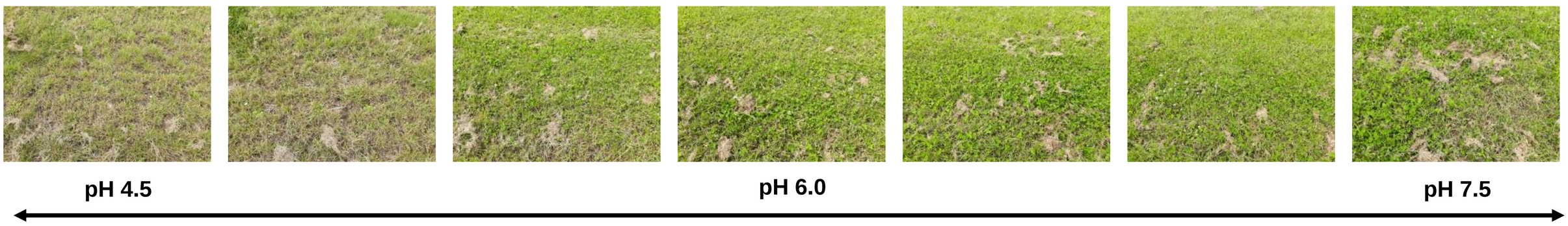
# Grass-Clover (48 year average)

**Grass-clover (Hay) -** At the lowest soil pH …. pH4.5, there is virtually no clover present in the sward. It is not until the soil pH reaches around pH5.5 that clover is present in any appreciable quantity, and it is not until a soil pH of around 6.0 is achieved that maximum clover levels are evident.

There is a slight tailing off of clover persistence at the higher soil pH's targeted in this experiment. Clearly the presence of clover in the sward, and its contribution to the nitrogen budget of the cropping system, is important especially if N fixation is a key requirement of the system, rather than relying on nitrogen fertiliser alone.

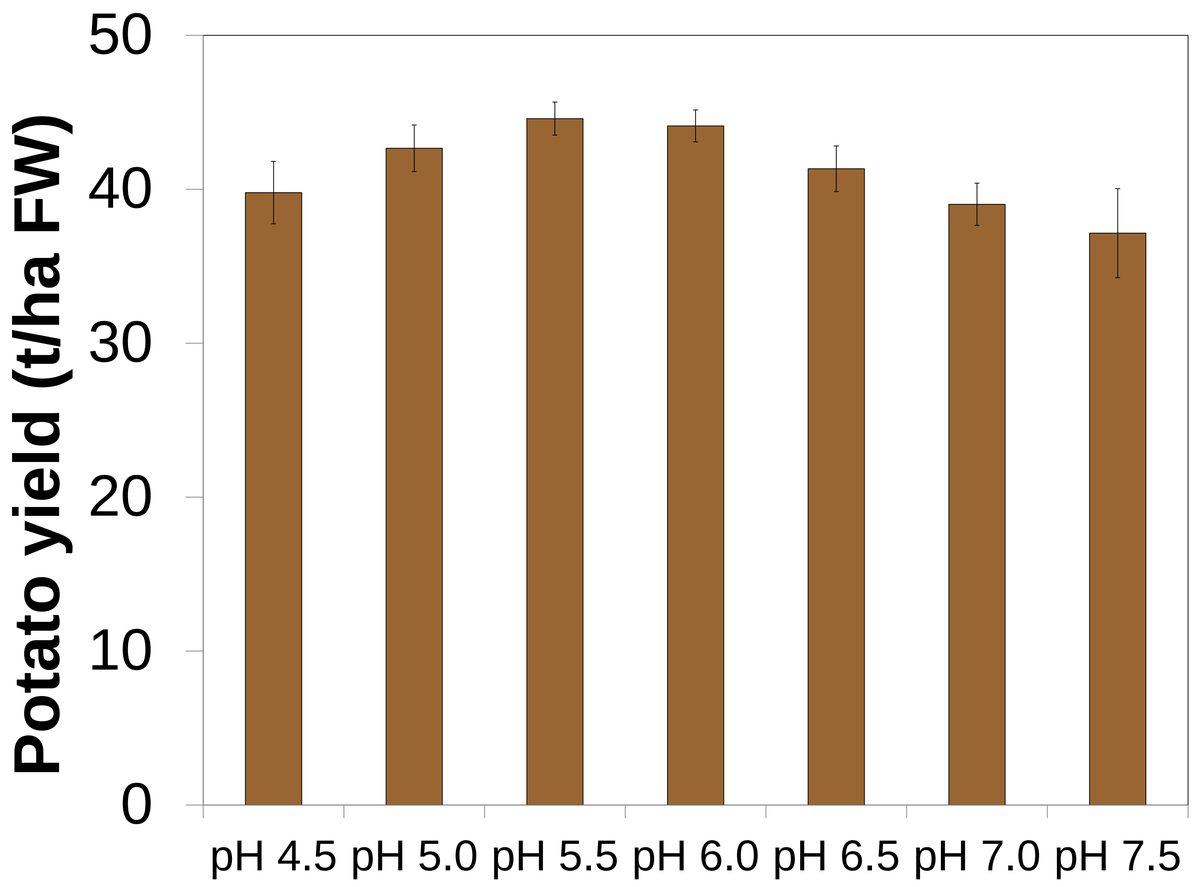
It must be remembered that modest amounts of fertiliser have been applied, and that nitrogen inputs aren't solely reliant on biological nitrogen fixation of the clover, particularly as there is little clover present in the lower soil pH treatments



**pH 4.5** **pH 6.0** **pH 7.5**

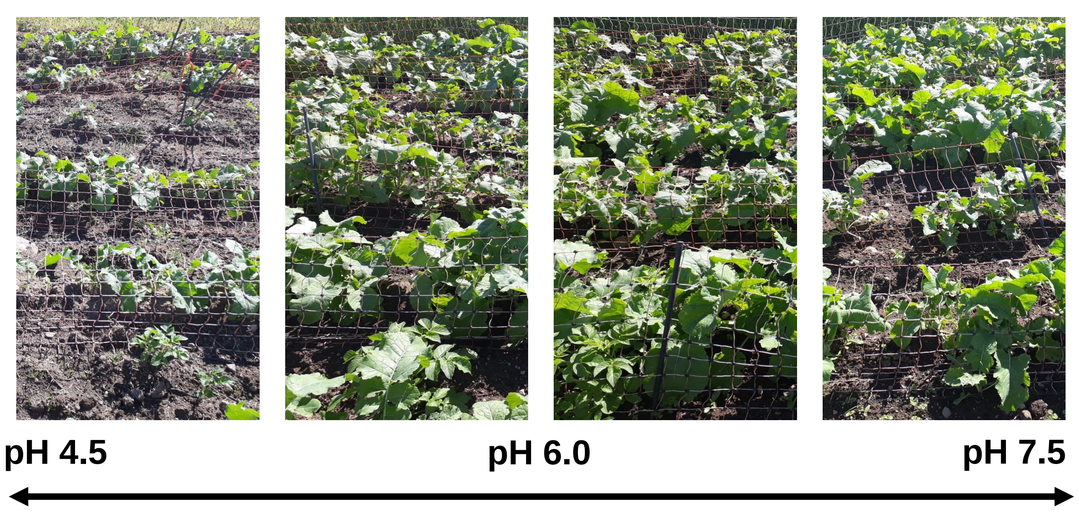
# Potato Crop (48 year average)

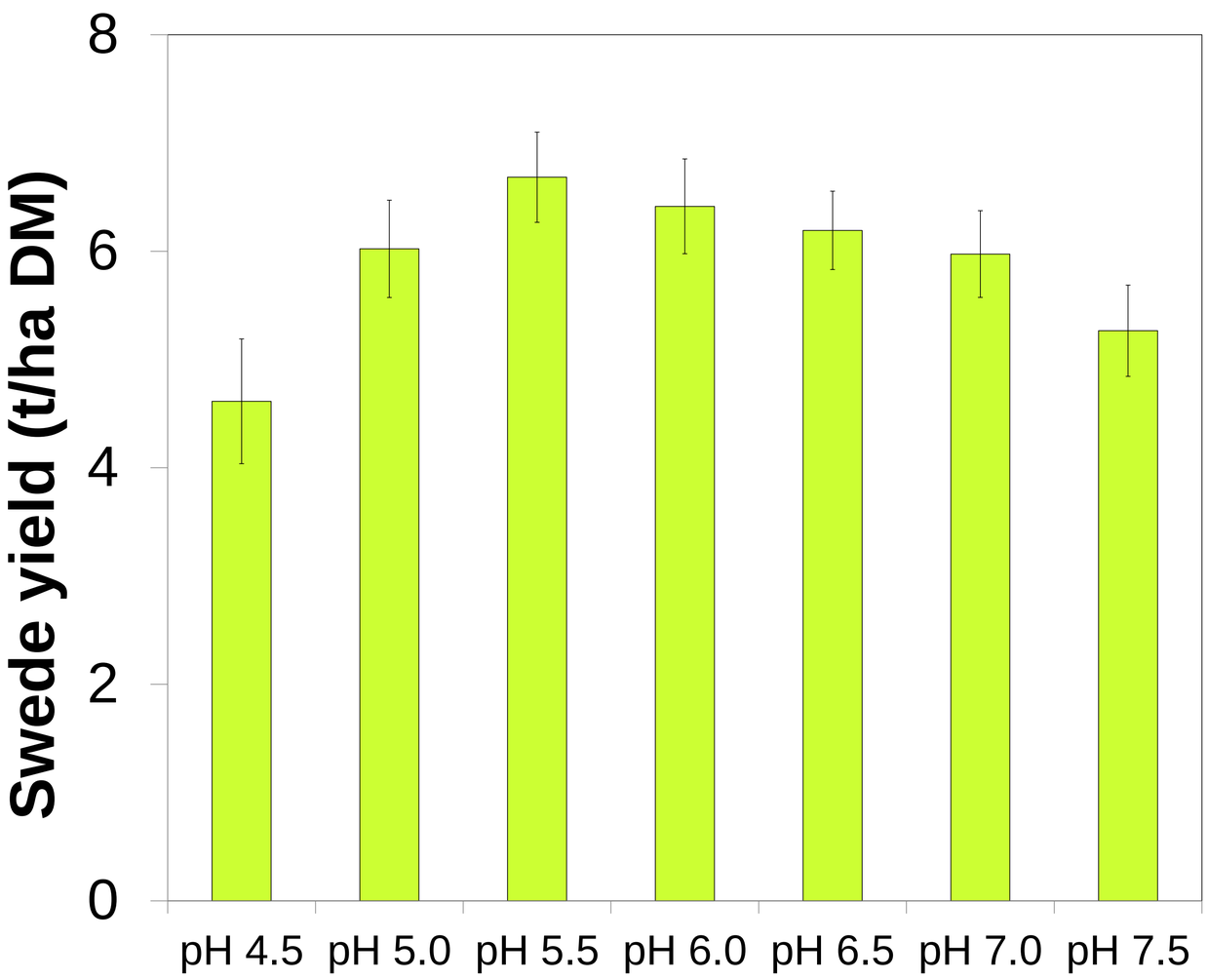



**Potatoes -** The impact of pH on potato yield is relatively small, although it can have an impact on tuber quality, for instance in the occurrence of the disease common scab in the higher pH treatments.


# Swede Crop (48 year average)

**Swedes -** The soil pH doesn't have a huge impact on swede yield, although in terms of crop quality and long term sustainability of crop systems with a brassica component, higher pH can reduce the influence of the disease clubroot.




## Summary

- These crops all grow well on soils modified to around pH5.5 to 6.0
- Soil samples would typically be taken as a well mixed bulk sample of several cores from across an area of maybe 4ha. A greater sample density might be expected if pH mapping was being undertaken
- Only a few grams of soil will be used to test pH in the lab, and these average results extrapolated upwards to the area sampled.
- It must be noted that the lab results are an average pH for the area samples
  - recommendations are usually towards pH 6.0 in order to avoid dropping below critical pH levels for key crops such as spring barley, as pH variability in the field could easily differ by as much as a half pH units from this average value.