Optimising soil fertility for grass production on heavy soils farms

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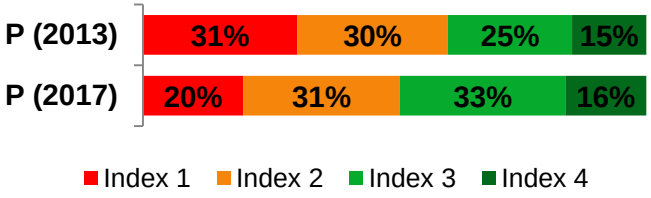
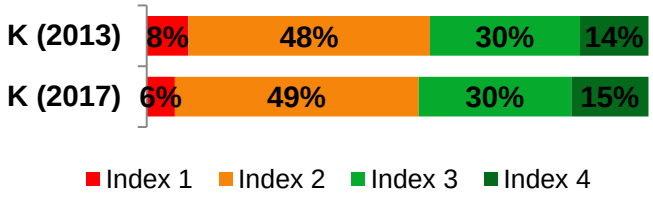
Background

- Heavy soils with high proportions of fine soil particles offer major challenges in terms of nutrient-use efficiency.
  - Generally low fertility status
  - High retention/lock up of nutrients
  - Poor access at certain times of the year
  - Slow build-up rates





- Understanding how the varying quantities of nutrients are supplied/retained will help to improve the strategies for fertiliser application.

Experimental Objective

- The objective of this project is to generate new knowledge of soil and fertiliser nutrient dynamics and use it to refine nutrient application recommendations for heavy soil grassland farming systems.

- Specific aims:
  - To investigate the **effect of lime and phosphorus application rate** on soil nutrient retention and availability across different soil types.
  - To characterise the effect of **soil drainage** status on nutrient storage, availability and loss
  - To determine the influence of **soil type, climatic variability and soil nutrient dynamics** on nutrient availability
  - To identify **appropriate fertiliser application rates** (N, P and K) for achieving target soil fertility and grass production levels
  - To develop new soil **specific nutrient management recommendations** for heavy soils farms

Sections

1. The effect of soil type on plant nutrient supply and fertiliser efficiency

2. The effect of soil type and nutrient input on nutrient losses

3. The effect of soil variability and nutrient management within the farm on herbage productivity

4. Nutrient use efficiency at farm scale

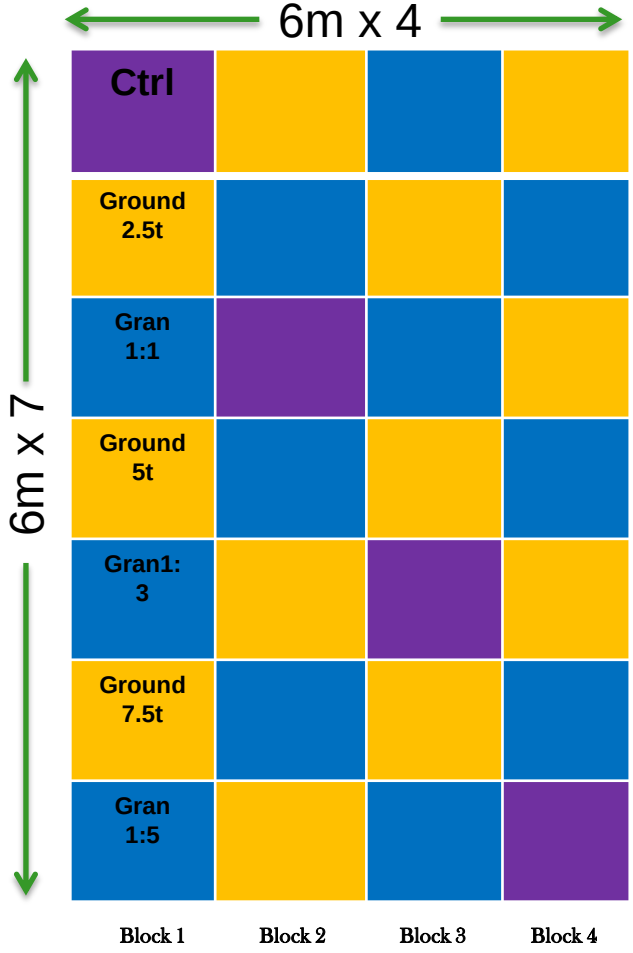
Section 1

Section 1

- The effect of soil type on plant nutrient supply and fertiliser efficiency

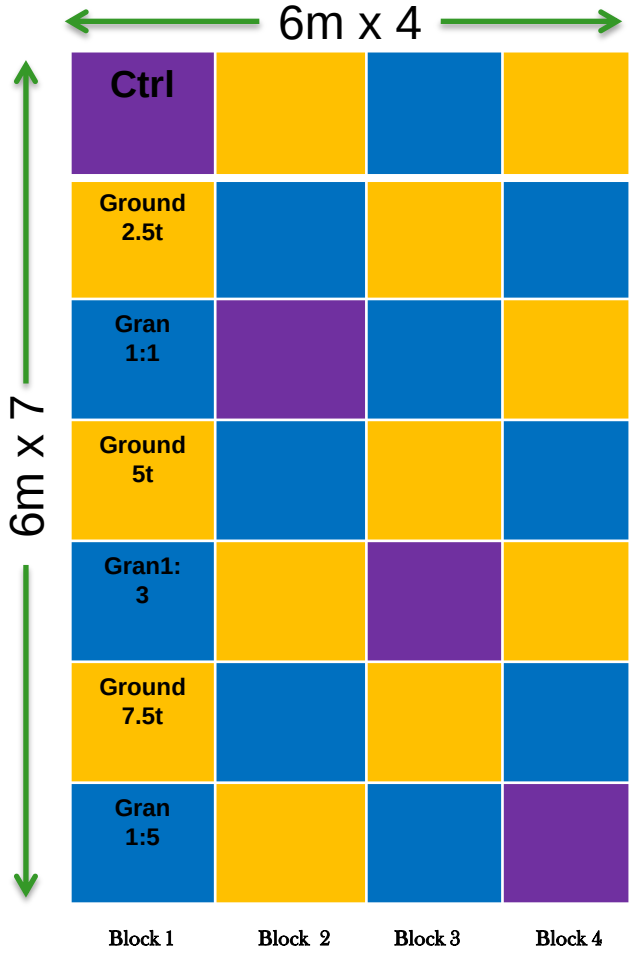
  - 3 Elements
    - » Lime Application trial (John O' Sullivan, Sean O' Riordan, John Leahy - March 2015)
    - » Phosphorus application trial (Established March 2018)
    - » Nutrient response rates of all soil types-Pot study (Samples from all farms- Feb 2018)

Section 1: Lime Application Trial



- 3 farms (Sean O'Riordan, John O'Sullivan, John Leahy)
- Established in March (S. O'R.) and September (J. O'S., J.L.) 2015
- 7 treatments (repeated 4 times on each farm)
  - Control
  - Ground Limestone at 3 rates
  - Granlime at 3 rates

Section 1: Lime Application Trial



- Plots revisited at 6-month intervals since establishment
  - Each plot soil sampled
  - Physical analysis of soil strength and bulk density

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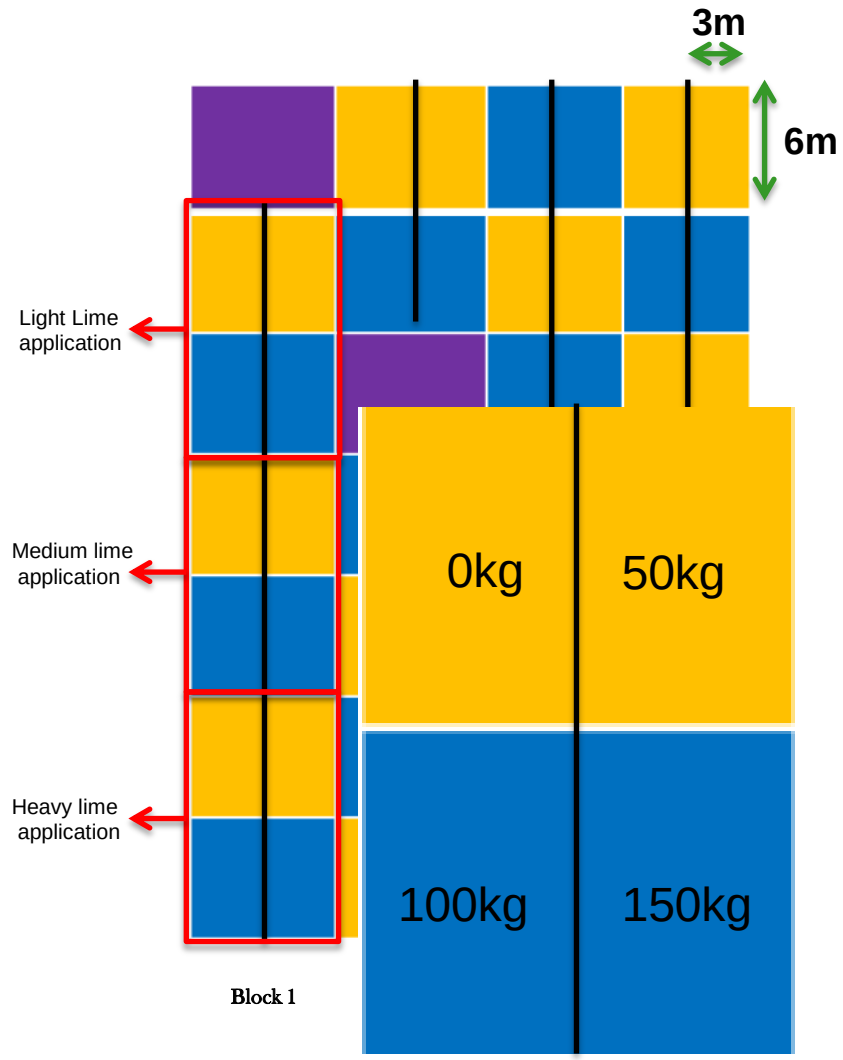
Section 1: Proposed Phosphorus Application Trial



- Superimposed on lime application plots
- High, medium, low pH exist after Lime trial
- Allows for influence of pH to also be considered

- Each existing treated plot will be split in two
- 4 rates of P split over 2 applications (March and May each year for 3 years)
  - **0kg/Ha (control)**
  - **50kg/Ha**
  - **100kg/Ha**
  - **150kg/Ha**

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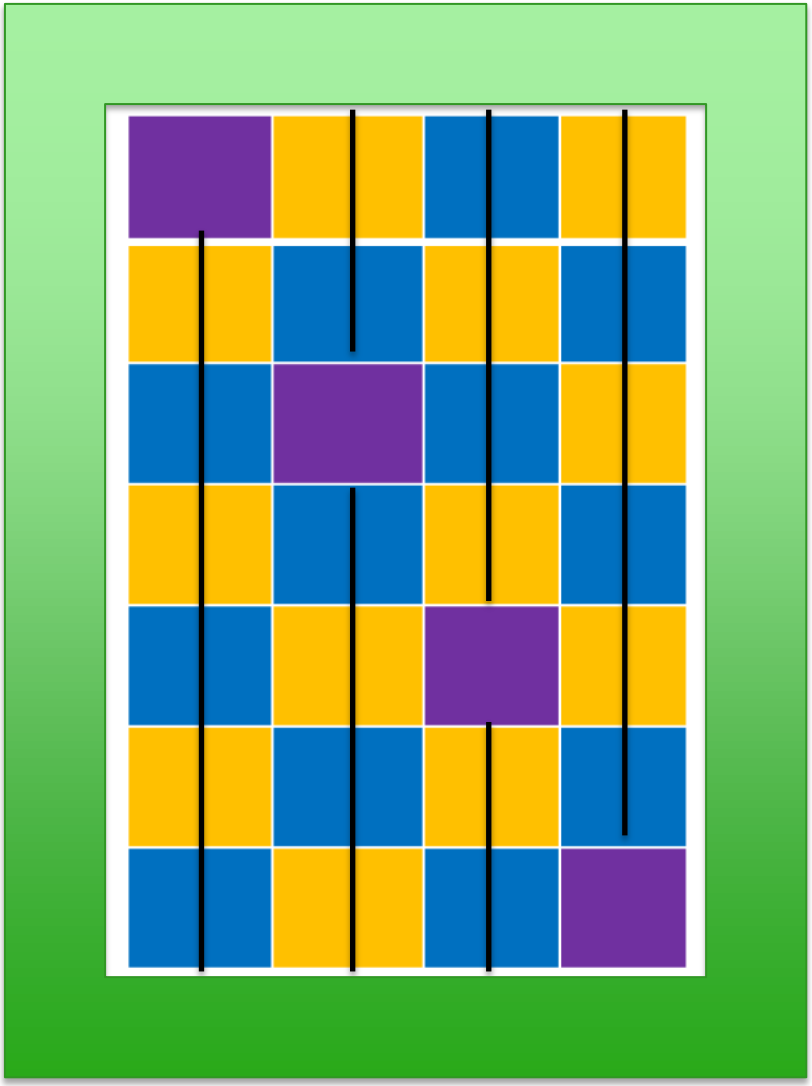
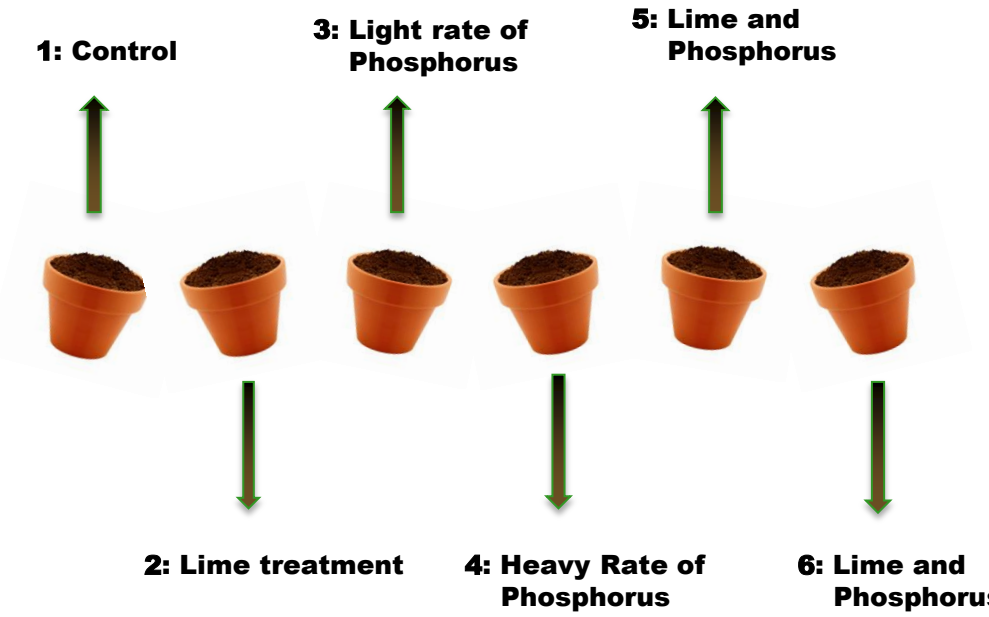
Section 1: Proposed Phosphorus Application Trial



- **Plots will need be isolated from the farmers routine application of compound fertiliser**
- A buffer zone will be setup and spread by hand
- Measurements
  - Herbage yield and quality pre-grazing throughout the grazing season
  - Soil test status (six month intervals)

Section 1: Response rates-pot study



- Pot vs. Plot- isolates effect of soil type
- 20 mineral soils (10 farms x 2 soil types) + 5 random organic soils
- Soil samples will be collected from pots for testing at 0, 3 and 12 months

- **25 soils x 6 treatments x 3 replications = 450 units**

  - Control
  - Lime treatment
  - Phosphorus at 2 rates
  - Phosphorus at 2 rates + Lime

Section 2

Section 2

- The effect of soil type and nutrient input on nutrient losses

  - 2 Elements
    - » Water sampling of surface and subsurface pathways
    - » Nutrient application and leachate testing from large cores collected from each farm

Section 2: Nutrient Loss

- Collect surface and subsurface (drain) runoff
- Sample throughout the grazing season
- Test nutrient content of water samples
- In co-operation with G. Smith

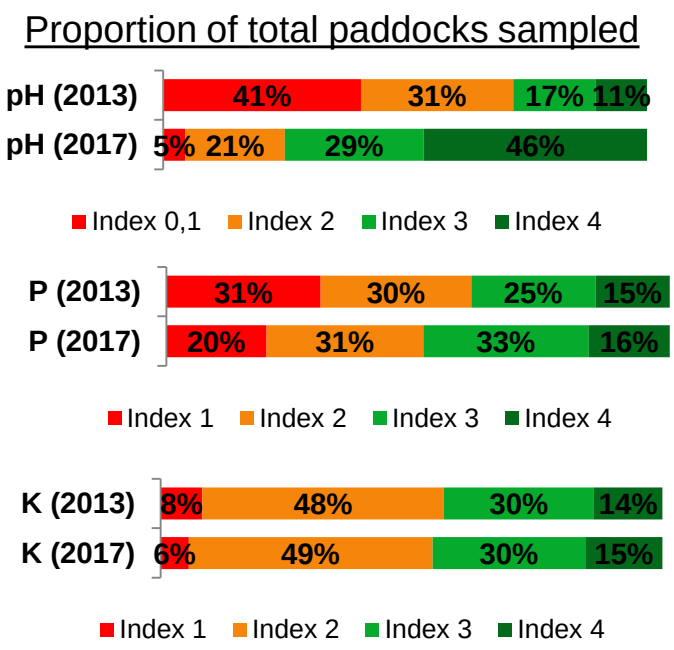
Section 2: Nutrient Loss

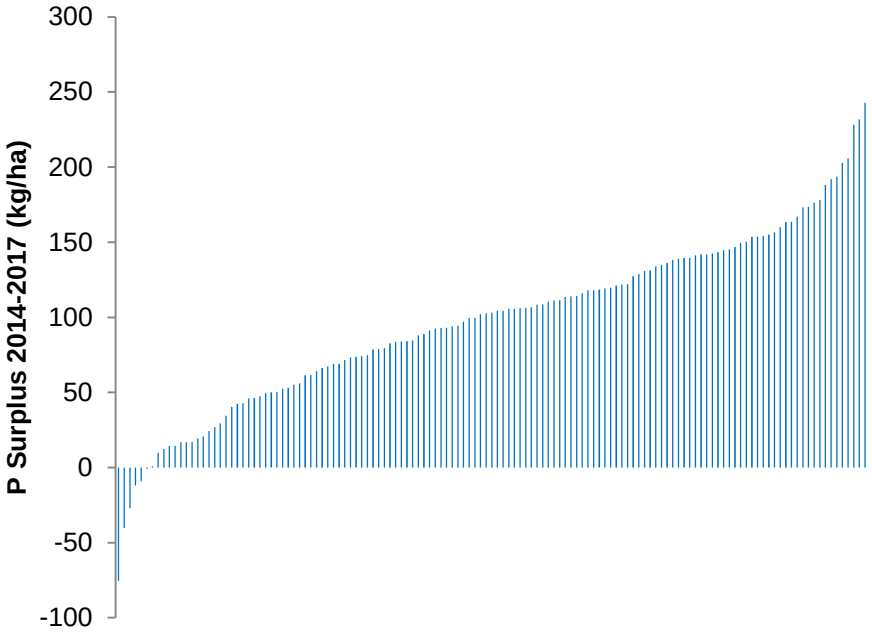
- Large soil cores (x 6 from each farm)
- Apply a standard rate of fertiliser and observe losses of N, P, K

Section 3

Section 3: Existing farm data

- Aim to assess farm scale data to look at variations in soil fertility, soil type and nutrient management
  - Examine paddock scale data in terms of inputs, offtakes and responses
  - Compare well and poorly performing paddocks
  - Determine dominant factors affecting soil nutrient status





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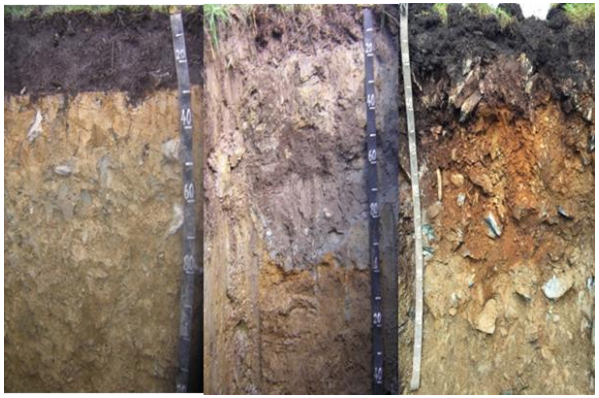
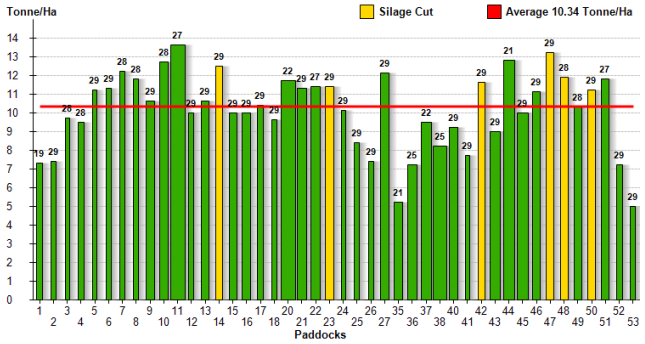
Section 3: Existing farm data

- The effect of soil variability and nutrient management within the farm on herbage productivity

  - Existing bank of farm data
    - **Soil test status**: Annual paddock data
    - **System inputs:** Fertiliser, lime, slurry, feed
    - **Management practices:** Grassland, fert. and slurry application strategies
    - **System outputs:** Herbage, Milk, Livestock etc.





Section 4

Section 4: Nutrient use efficiency at farm scale

- Develop a nutrient management strategy to improve soil fertility across a range of different soil types.
- Develop a management strategy in order to reduce the loss of nutrients through runoff, leaching and nutrient lock up.
- Develop a plan that is financially viable for the farmer. It is important that the returns on investment in soil fertility is greater than the input.
- A strategy will be created to comply with environmental legislation while maximizing the farms agronomic potential.

Thanks for Listening!

Any Questions