Rootzone reality – a fluxmeter network to measure and manage N leaching losses on cropping farms

PAANZ Workshop – Technology to reduce N leaching

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A rapidly changing farming landscape

- Goal of farmers hasn't changed – **Farming for profit while minimising losses**
- Period of regulatory change – **intent vs demonstrate**
- Rise of tools for predicting whole farm outcomes and setting associated policies
  - **Model vs measure**
  - Recognition that farming systems are complex!

Plugging a gap – ‘Rootzone reality’

- Provide growers and regional authorities with robust **measurements of N and P leaching losses** from cropping farms across **sites and seasons under GMP’s**

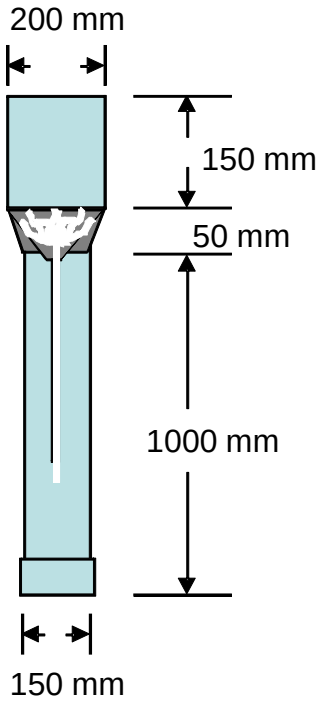
- Why?
  - Need more measured data for **discussion**
  - Need an idea about whether GMP’s have the desired **impact**
  - Need to do it together to **inform** models and policy

Overview:

- **Summary of network and sites**
- **Year 1 findings**
- **The role for precision technologies?**

Measuring losses - tension fluxmeters

- **Why use tension fluxmeters?**
  - Permanent and non-intrusive
  - Capture complete drainage events
  - Cost-effective approach
- **What is a tension fluxmeter?**
  - PVC pipe that intercepts drainage (stores ~14 L)
  - Silica sand and DE reduce sediment transfer
  - Passive wick
  - Drainage pumped to surface through plastic tubes

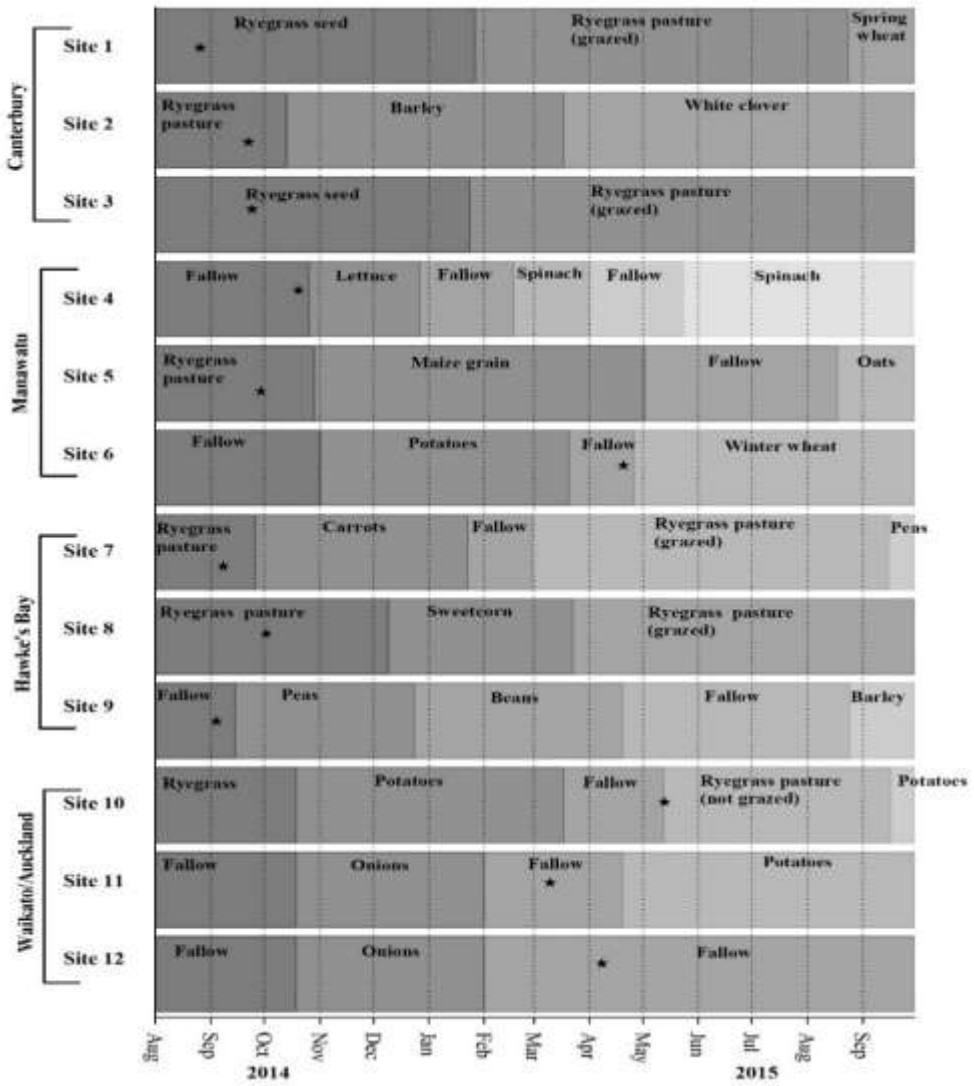





Context - installing and testing fluxmeters

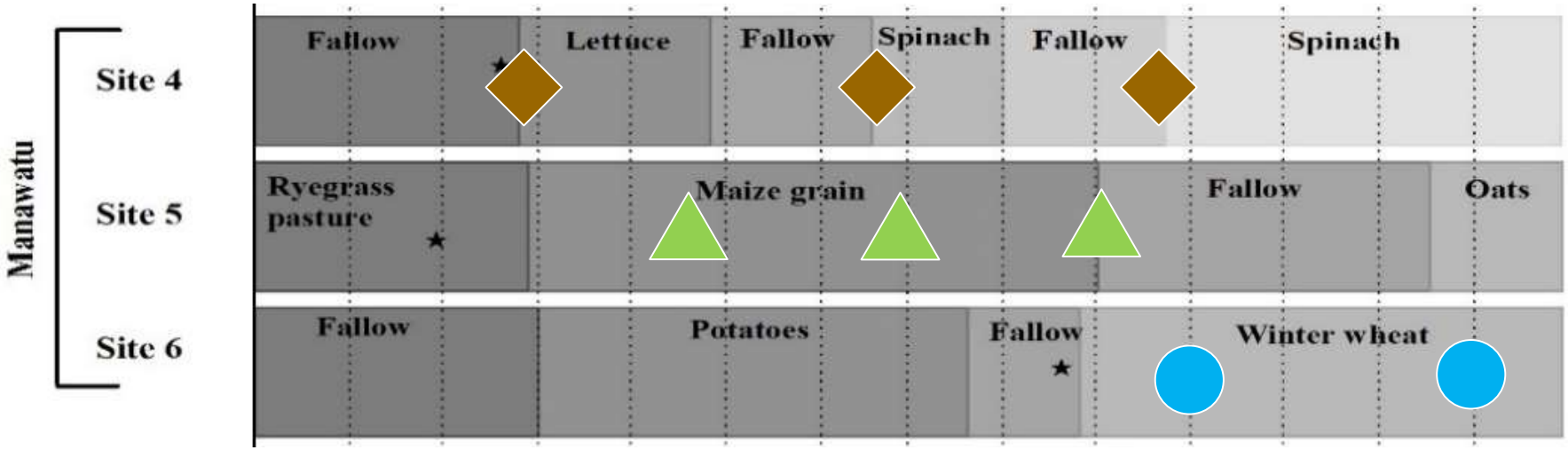
- **Installation process**
  - Representative areas of fields, not extremes
  - Hole augured, unit lowered, soil carefully repacked
  - Top of fluxmeter is at a depth of 1.0 m
- **Testing performance**
  - Disturbed soil needs to settle
  - Soil water balances to look at inputs (irrigation + rainfall) and outputs (drainage)

The fluxmeter network



- **Network design**
  - Four monitor regions
  - Three sites per region
  - 12 fluxmeters per site (144 units)
- **Sites**
  - Commercial fields
  - Range of soils, climates and management practices
  - Avoided high water tables, artificial drainage and stones

Key measurements



Soil fertility (N, P, C…)

Crop biomass (DM, N uptake, export)

Drainage (volume, NO_3, NH_4, DRP, Total P)

Drivers of nutrient losses – loading and drainage

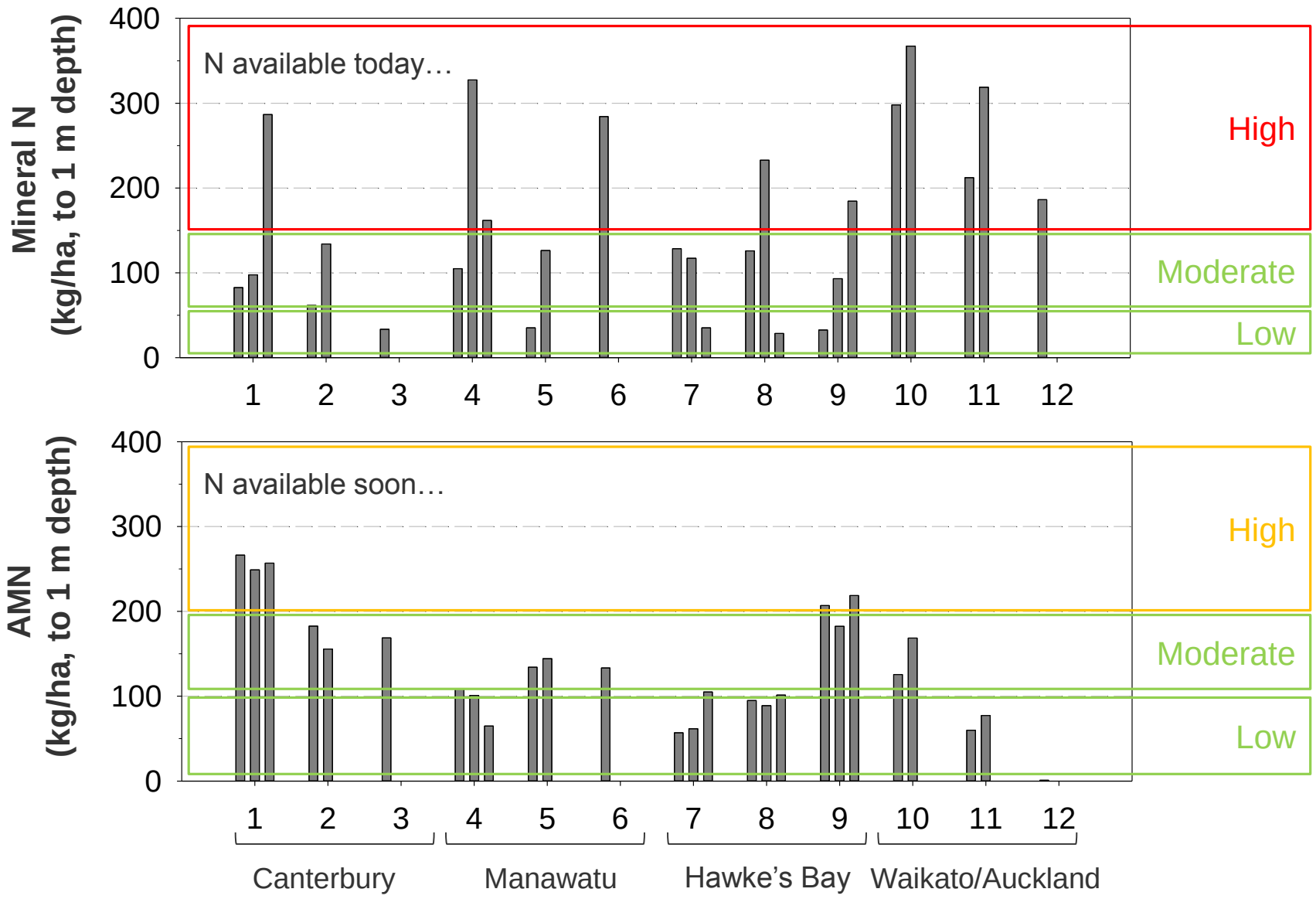
	Low drainage	High drainage
Low soil fertility	Low loss	Low loss
High soil fertility	**High risk**	**High loss**

Implication: manage soil fertility and drainage

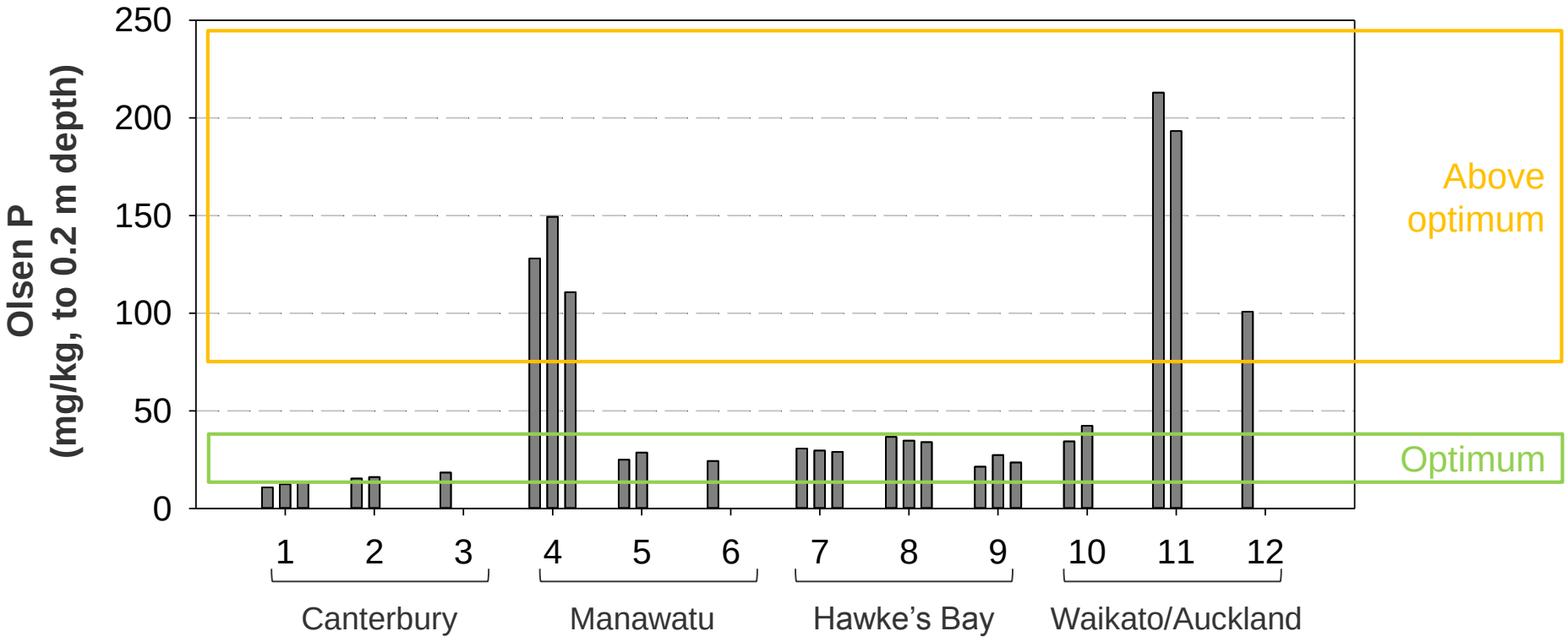




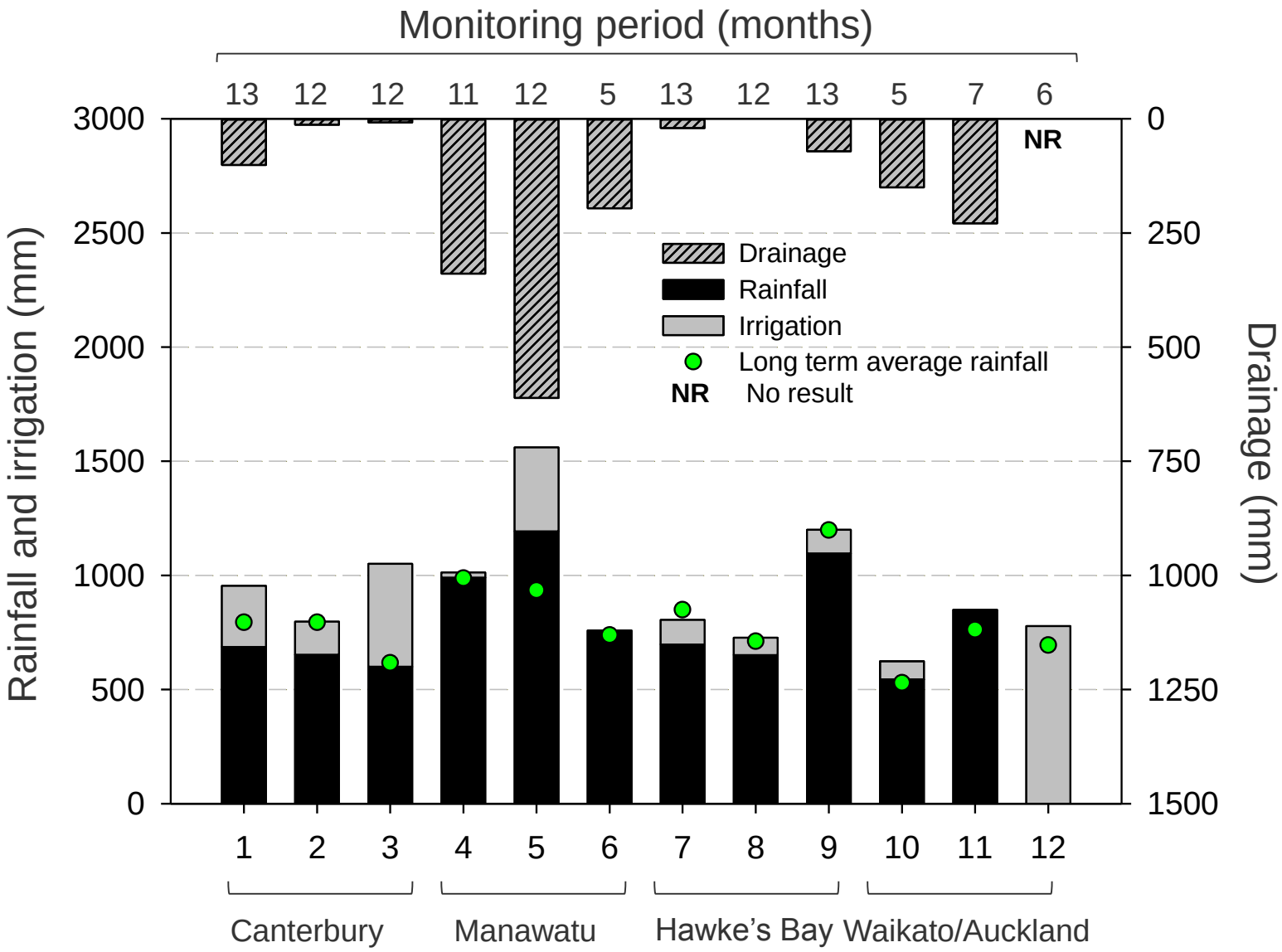
Measured loading – soil nitrogen



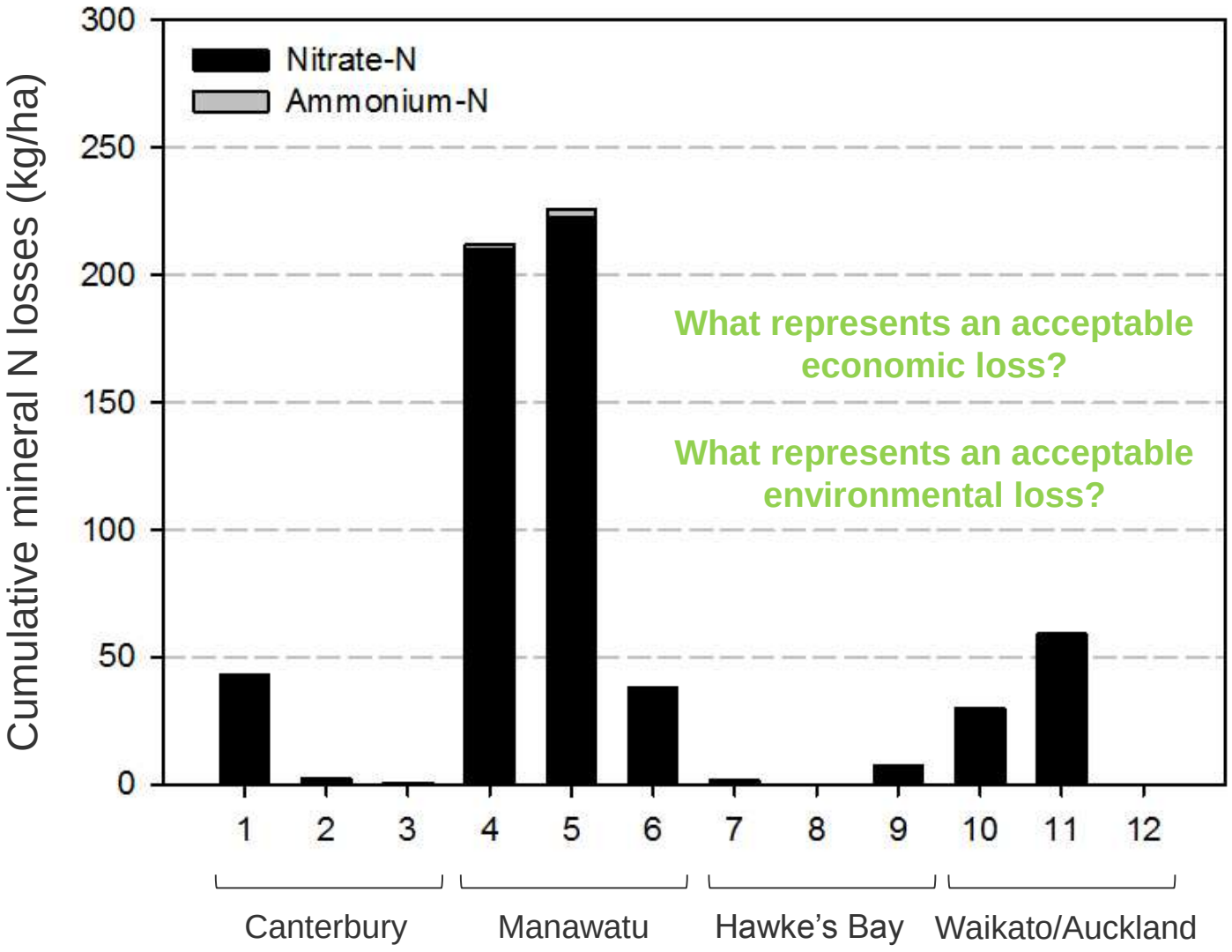
Measured loading – soil phosphorus



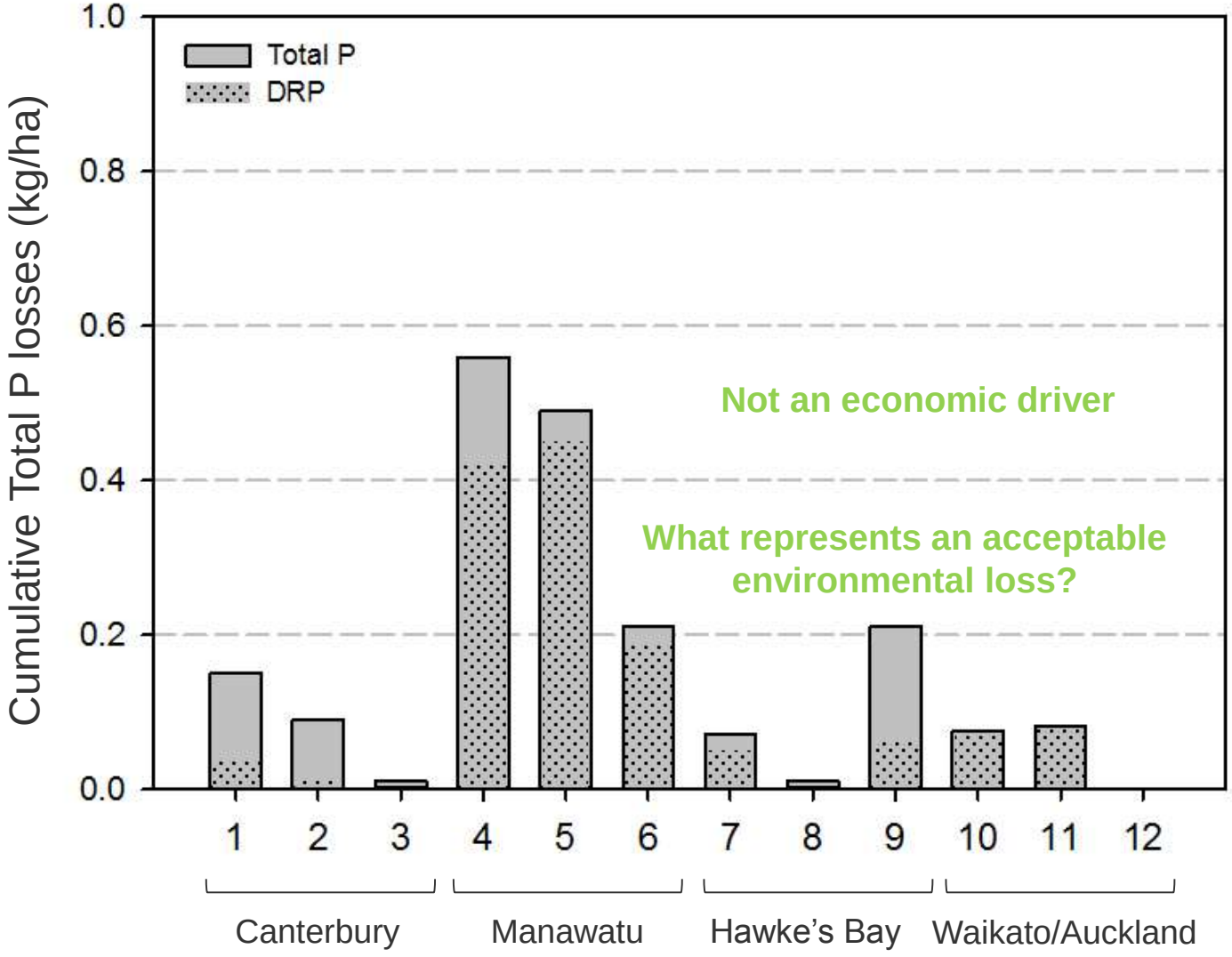
Measured drainage



Measured nitrogen losses



Measured phosphorus losses



Overall synthesis from network to date

- Key stats since installation and October
  - Captured drainage ranged from 0.3 to 611 mm
  - N losses ranged from **0.2 to 226 kg N/ha**
  - P losses ranged from **0.01 to 0.56 kg P/ha**

- **Winter and spring losses** dominate
  - Rainfall is a key driver; reduce loading?
  - Irrigation not resulting in significant drainage during summer
- High soil N and P levels = **high risk**
- Value of data increases with **long-term trends…**




Implications for precision technologies?

- Tight management of water and nutrients is important to limit losses
  - **GMP's are working**
  - **Precision technologies can also help**
- Likely to require different solutions
  - mapping, sensing, VRI, VRN…
- **How to decide what to use and when?**

Acknowledgements


Grower collaborators

Project managers: Diana Mathers (FAR) and Angela Halliday (Horticulture NZ)

PFR team: Matt Norris, Shane Maley, Mike George, Gina Clemens, Steve Thomas, Steve Green, Carlo van den Dijssel, Paulo Zuccarini, Nathan Arnold, Adrian Hunt, Christina Finlayson, Glen Clark and Peter Wright.

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