Initial testing of the Overseer plantain block model

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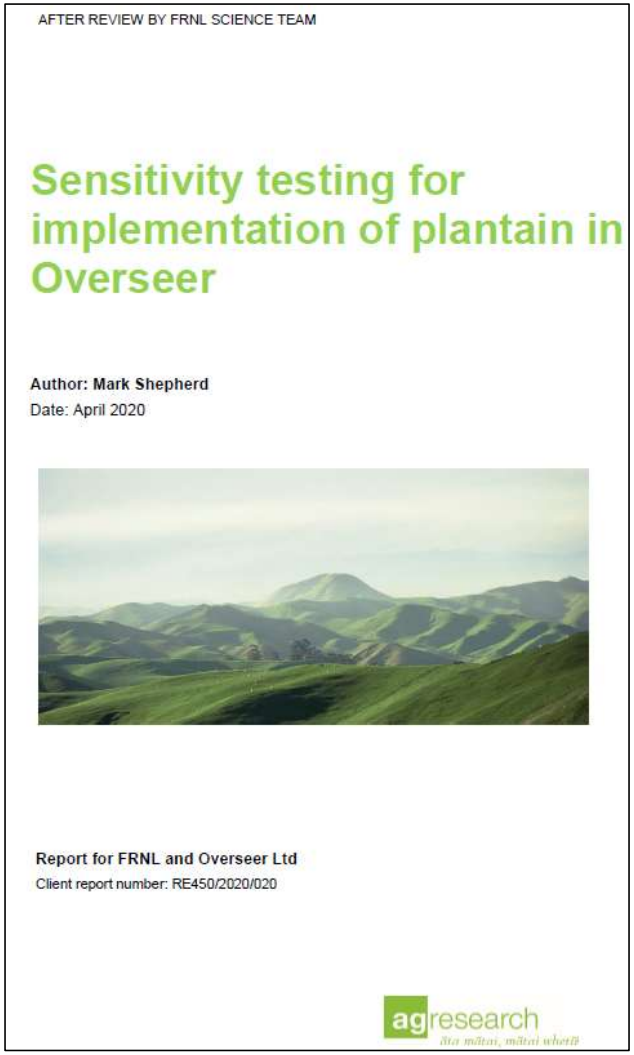
Introduction 1

- This slide set should be viewed in conjunction with Shepherd (2020; 'Sensitivity testing…')
- The report describes:
  - The rationale for the modelling approach
  - An approximation of the size of reductions in N leaching expected after implementation into Overseer
- This slide set:
  - Provides evidence that the model has been correctly implemented by comparing actual results with expected results
  - Summarises the N leaching reductions achieved when the model was applied to a test dataset



Introduction 2

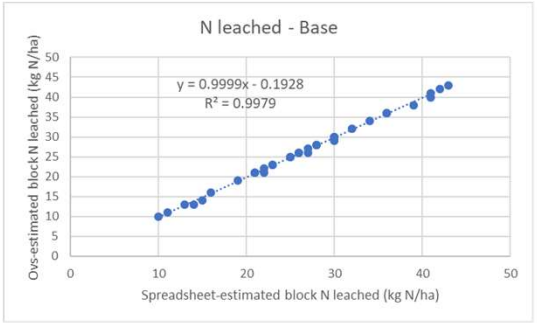
- The Overseer plantain model is based on the proportion of plantain in the diet modifying:
  - Proportion of excreta N as urine N
  - Urine patch N load
- Based on approval of this approach from the FRNL science team, algorithms were then implemented in an OverseerSci Test environment for evaluation before release
- Two datasets were used for the evaluation, based on:
  - Four Tararua farm scenarios that were also modelled with the Whole Farm Model to estimate the farm-level reductions in N leaching achieved by changing to plantain pastures with 10-60% plantain
  - C. 20 monitor farms from the FRNL programme, covering farms with a range of pasture and crop blocks

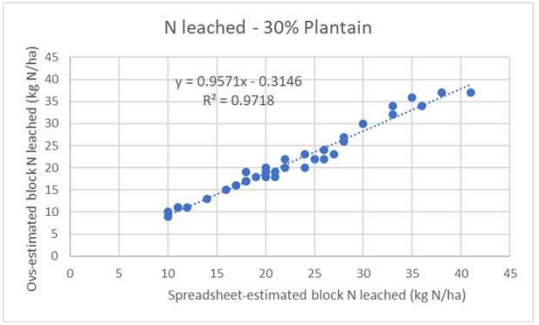
Evaluation methodology

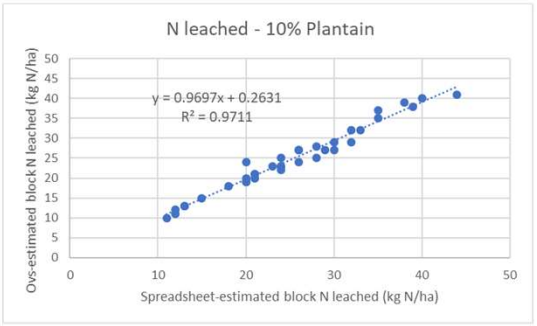
- We focused on:
  - Modelled pasture block N leaching (kg N/ha)
  - Estimated reduction in N leaching (% of base with no plantain):
    - At pasture block level
    - At whole farm level
- The evaluation tested whether the implemented model was producing 'expected' results
- By 'expected results' we mean the estimates reported by Shepherd (2020) and signed off by the FRNL science team as being of the right order.
- The results were generated from a simplified version of the model using the OverseerSci sensitivity tool and modified in a spreadsheet to construct farm and block level N leaching estimates ("spreadsheet model")
- The aim was to check that the results generated by the implemented model were similar to the preliminary results generated by the spreadsheet model, thus confirming the implemented model was functioning as we intended.
- It was not expected that the results would be an exact match because the model implemented in Overseer is able to capture farm-scale interactions (e.g. with supplements in the diet) that the initial spreadsheet calculations weren't able to capture

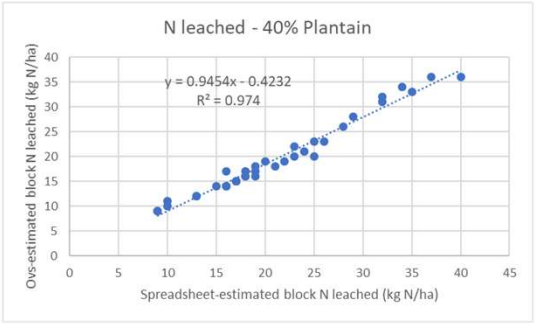
Comparison with expected results - *Tararua*

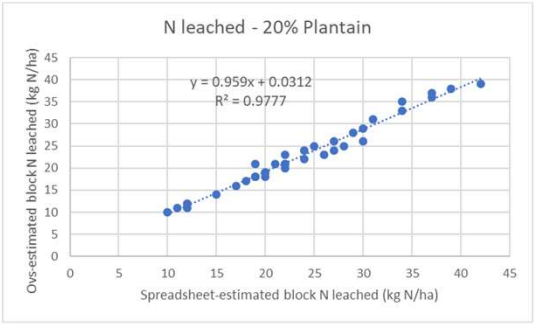
- There was reasonable agreement between the spreadsheet and OverseerSci Test estimates of block-level N leaching (pasture blocks) for the four farms and a range of plantain levels in the pasture

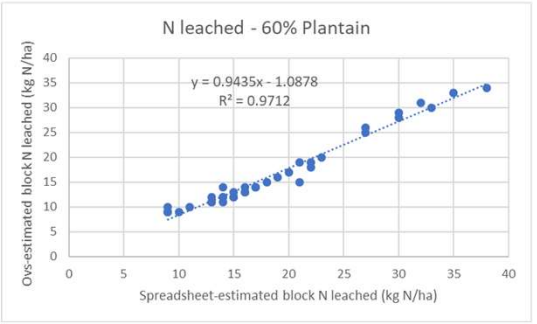






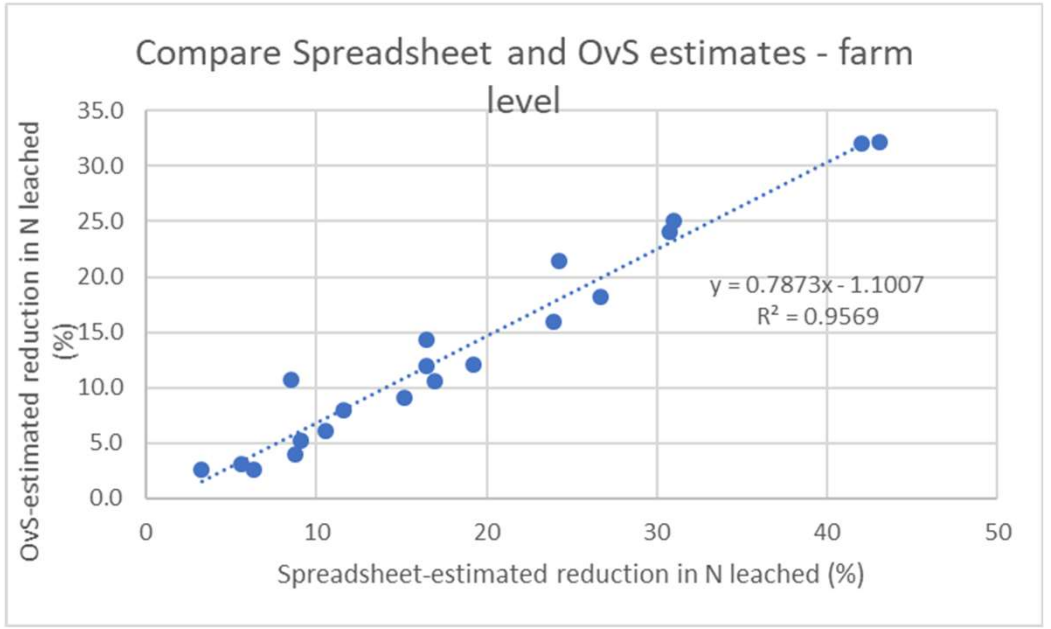






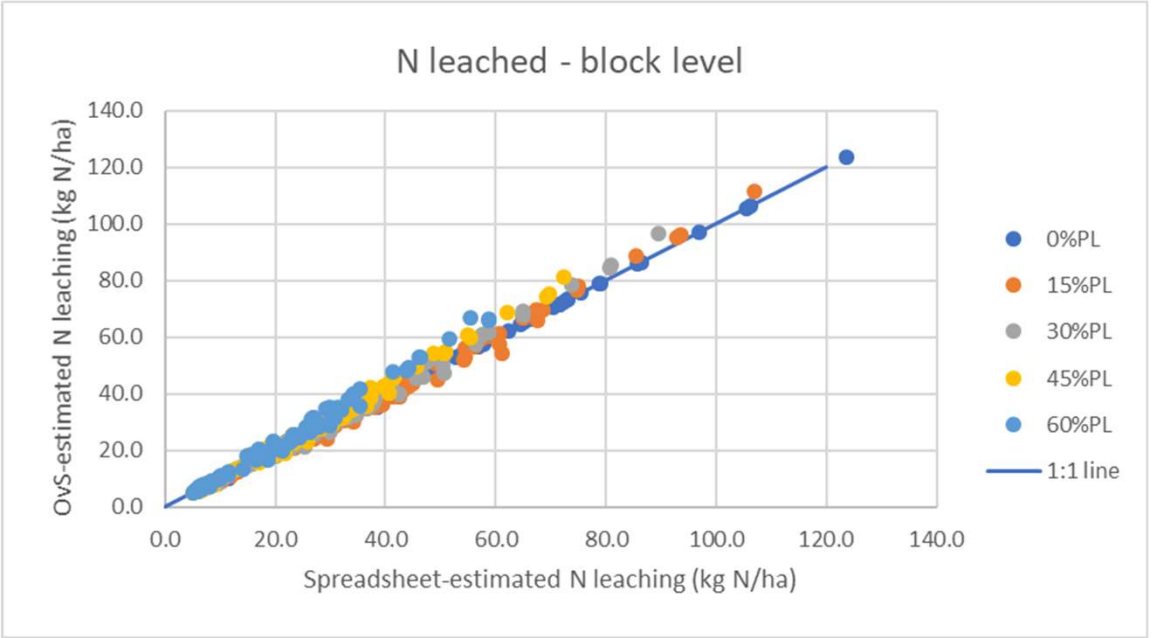
Comparison with expected results - *Tararua*

- At the farm-level, the OverseerSci Test estimated a reduction in N leaching of c. 80% of the external spreadsheet results.



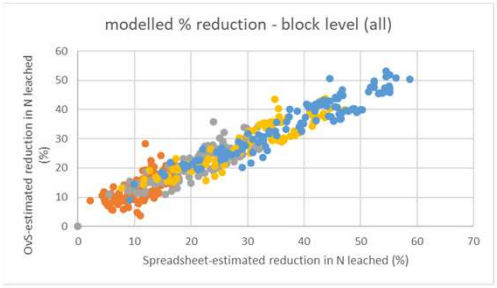
Comparison with expected results - *Monitor Farms*

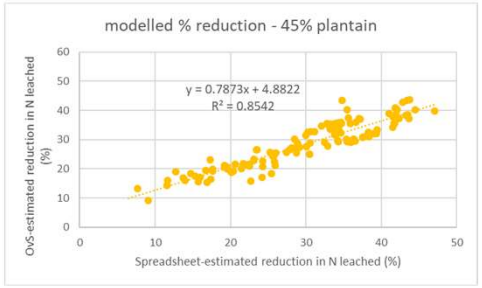
- There was reasonable agreement between the external spreadsheet results and OverseerSci test results of block-level N leaching (pasture blocks) for the monitor farms and a range of plantain levels.

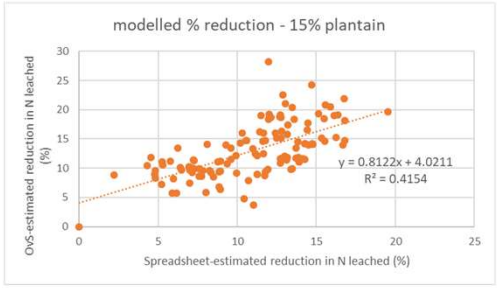


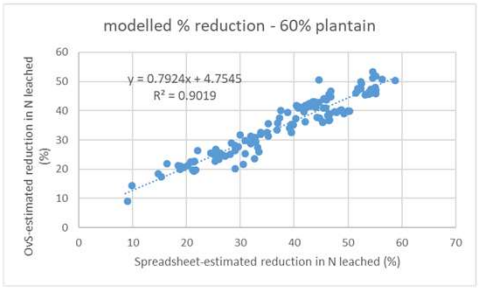
Comparison with expected results - *Monitor Farms*

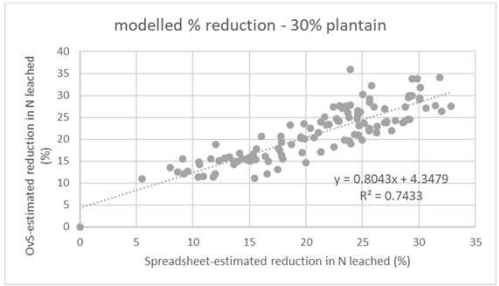
- Correlation between spreadsheet and OverseerSci test estimated reductions in N leaching improves at higher levels of plantain
- This is because small differences between models in estimated kg N/ha leached at lower plantain levels has more impact on the calculated reduction (% of base)
- As a mean of 125 block estimates, agreement between the spreadsheet and OverseerSci test estimates is reasonable









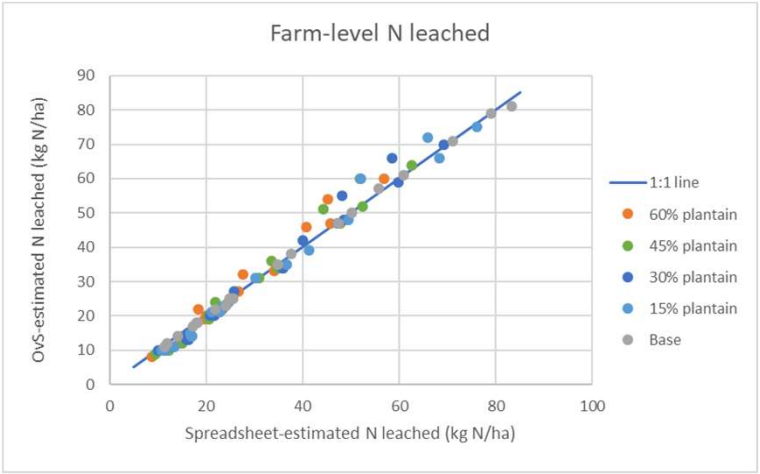


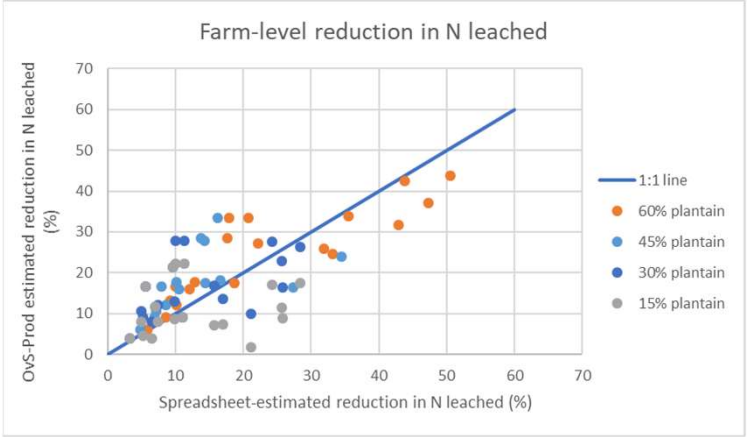
	OvS	Spreadsheet
15% Pl	11	13
30% Pl	21	21
45% Pl	30	29
60% Pl	38	35

Average % reduction in N leaching (block-level)

Comparison with expected results - *Monitor Farms*

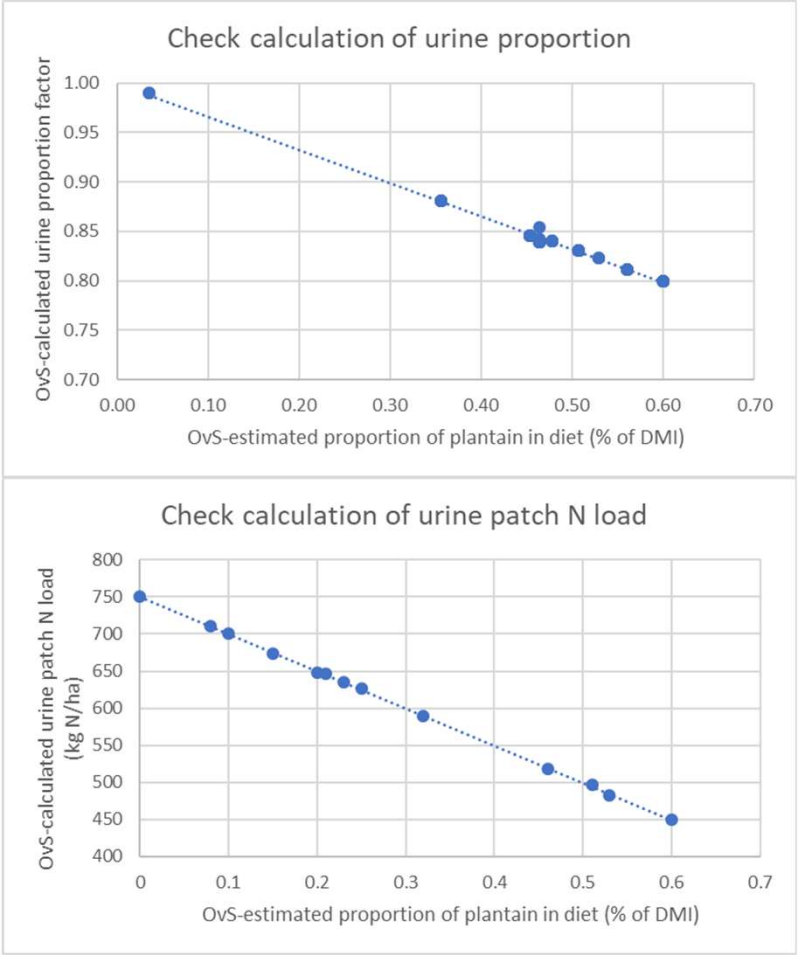
- There was reasonable agreement between the spreadsheet and OverseerSci test estimates of farm-level N leaching for the monitor farms and a range of plantain levels in the pasture blocks.
- Despite reasonable agreement between the two models in N leached, farm-level reductions show some scatter when comparing the initial spreadsheet estimates with OverseerSci.
- Small differences in N leached at a farm level magnify apparent differences when expressed as a % reduction, especially at lower plantain levels





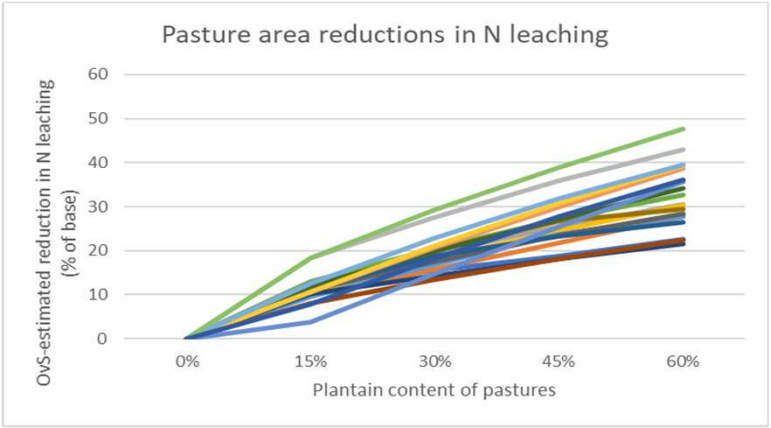
Results - *Checking parameter calculations*

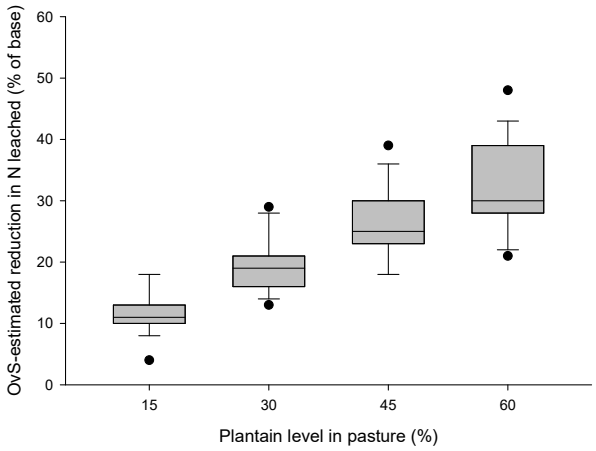
- The OverseerSci Test version reported the calculated parameters for proportion of excreta as urine N and urine patch N load
- Values for both parameters were as expected for differing proportions of plantain in the diet, confirming the algorithms had been correctly implemented.
- More detailed testing has also been done by Overseer Ltd as part of their QA procedures



Summary of results produced by the implemented model

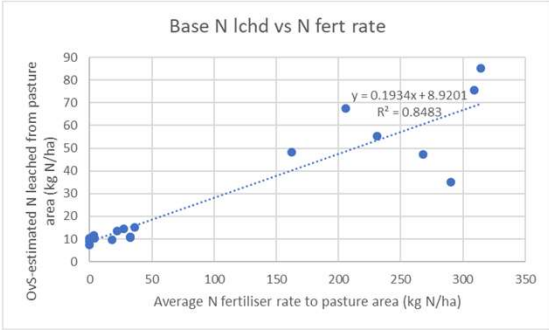
- With the Monitor farm dataset, there was variation in the % reduction in leaching achieved over the pasture area of each farm
- Reduction, on average, was linear with increasing pasture content
- At the farm-level, benefit on the pasture blocks will be 'diluted' by the non-pasture area on the farm

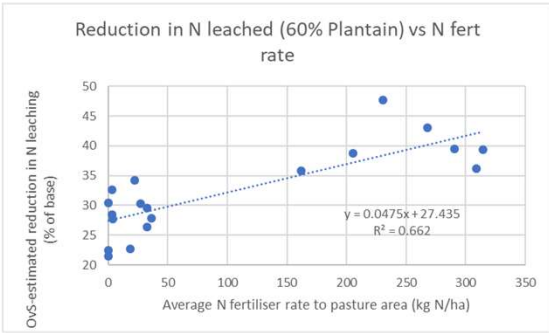


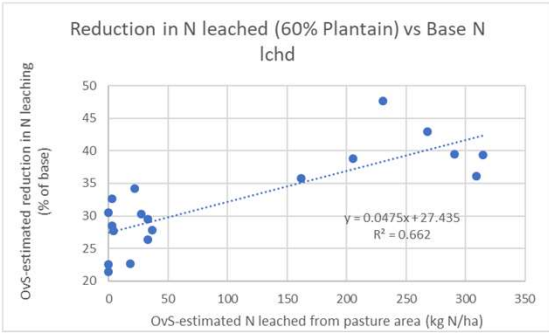


Summary of results produced by the implemented model

- Much of the variation in % reduction in N leaching achieved in each of the monitor farm examples on the previous slide was explained by the 'intensity' of the pasture system
- The greater the 'intensity', the greater the reduction in N leaching achieved with plantain
- 'Intensity' was described by N fertiliser use on the pasture or base N leaching (both were related: see top graph)

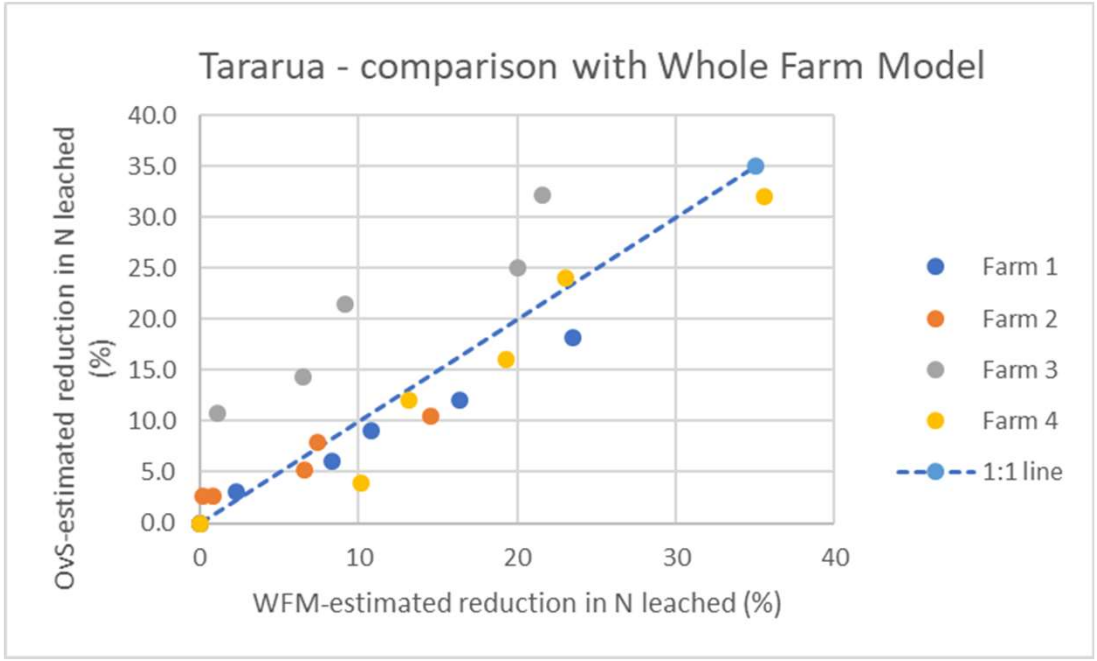






Comparison with other model values - Tararua

- With no block-level measurements of N leaching available, we compared with other modelling results
- There was reasonable agreement between DairyNZ's Whole Farm Model and OverseerSci Test results.



Conclusions

- Some differences between the results from OverseerSci test and the results generated in an external spreadsheet were expected, due to the simple approach taken using spreadsheet calculations
- However, results are of the same order when the two models are compared
- **Because the initial results generated by the spreadsheet model were considered to be reasonable by the FRNL science team, we therefore conclude that the implemented model is also a reasonable representation of the effects of plantain pastures on estimated N leaching**
- Other factors could be considered in future versions of the model if more science becomes available including:
  - Seasonal variation in plantain
  - Urine patch overlap at high stocking rates
  - Effects on soil nitrogen cycling processes

Forages for Reduced Nitrate Leaching is a DairyNZ-led collaborative research programme across the primary sector delivering science for better farming and environmental outcomes. The aim is to reduce nitrate leaching through research into diverse pasture species and crops for dairy, arable and sheep and beef farms. The main funder is the Ministry of Business, Innovation and Employment, with co-funding from research partners DairyNZ, AgResearch, Plant & Food Research, Lincoln University, Foundation for Arable Research and Landcare Research.