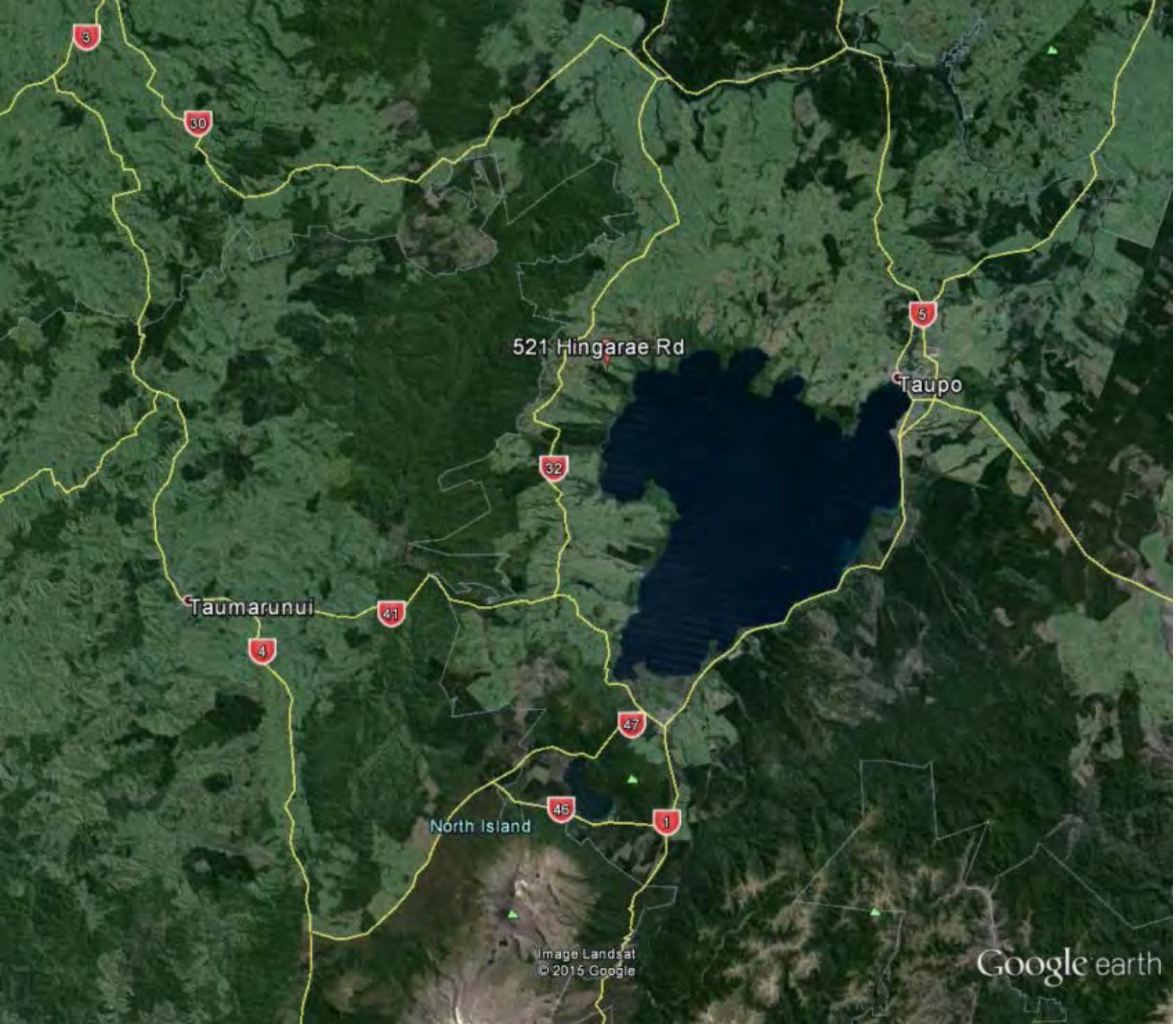
Landcare Research
Manaaki Whenua

Nitrogen leaching from cut-and-carry lucerne

Malcolm McLeod
Landcare Research


3
30
521 Hingarae Rd
5
Taupo
32
Taumarunui
41
4
47
46
1
North Island
Image Landsat
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Google earth

Context

- Water in Lake Taupō is deteriorating due to increasing nitrogen levels
- WRC adopted a target of 20% reduction in manageable-N entering the lake
- Now, each farm in the Taupō catchment has a nitrogen discharge allowance

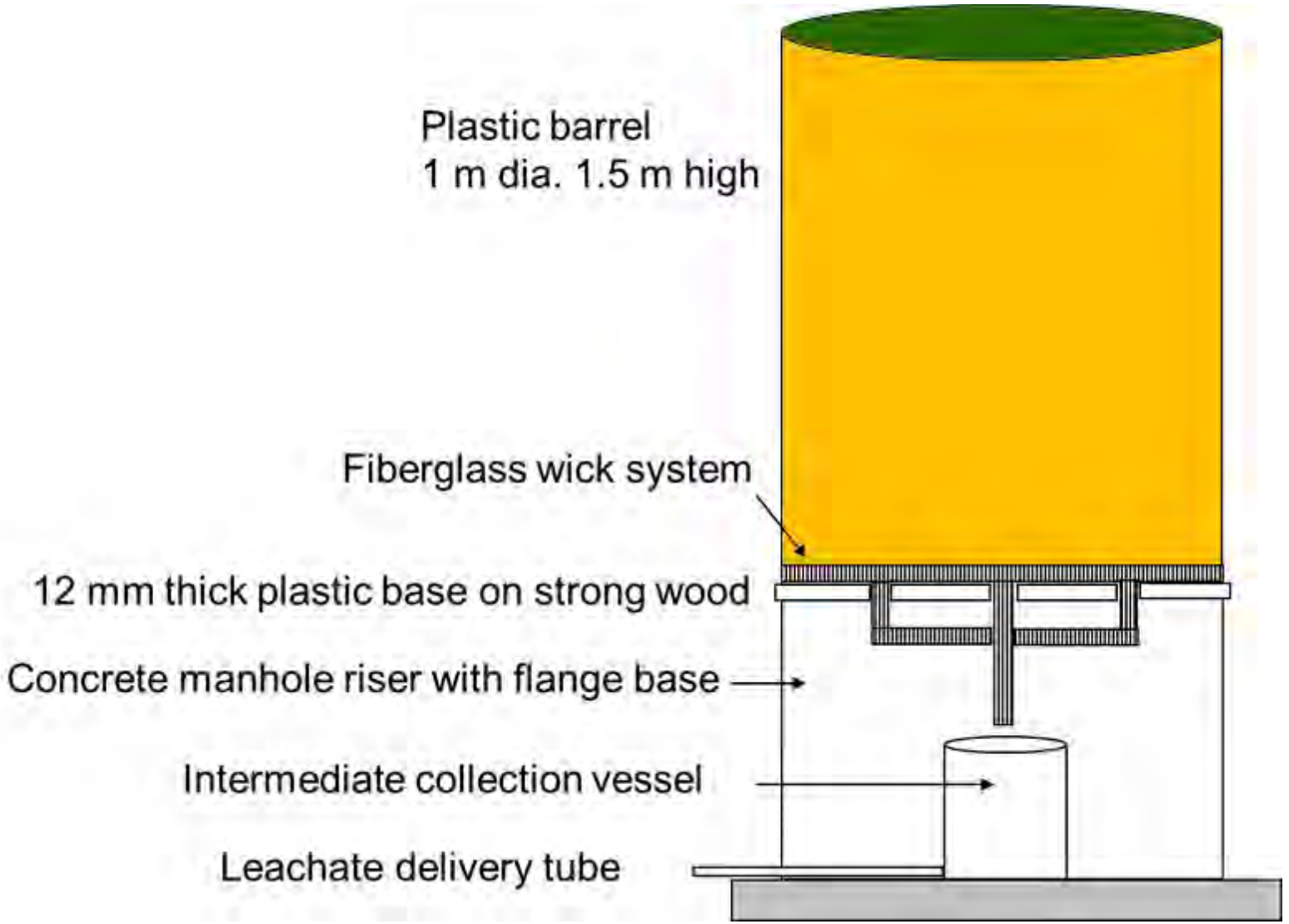
Lucerne

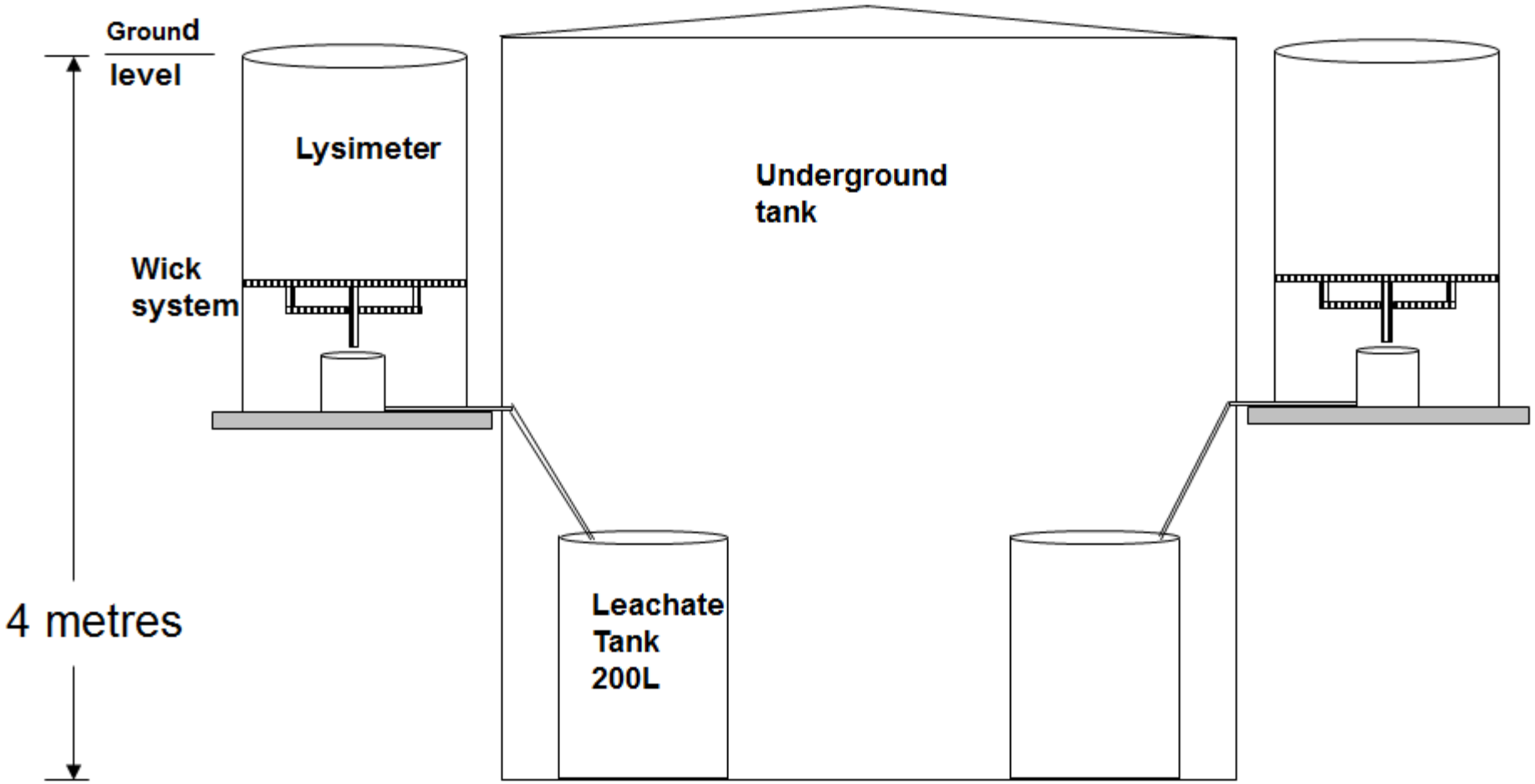
- Lucerne is a high value crop requiring no nitrogen fertiliser - potential
- Allowance modelled using Overseer® V5
- Then, no module for cut-and-carry lucerne

Published rates of N leaching under lucerne

- 2 to 26 kg/N/ha/y (native forest 3, dairying ~35)
- 26 kg/N/ha/y was down the road, Puketapu
  - Different aim – production
  - 20 kg/N/ha added as fertiliser
  - Measured at 60 cm
    - using suction cups
- Current research
  - Measure N leaching at a depth of 1.5 m
    - Using barrel lysimeters

Lysimeters


Plastic barrel
1 m dia. 1.5 m high
Fiberglass wick system
12 mm thick plastic base on strong wood
Concrete manhole riser with flange base
Intermediate collection vessel
Leachate delivery tube


Ground
level
Lysimeter
Underground
tank
Wick
system
Leachate
Tank
200L
4 metres

Experimental setup

- 4 replicates **ryegrass/clover**
  - Not cultivated
  - Harvested on same rotation as farm

- 4 replicates **lucerne**
  - Cultivated to plant crop
  - Harvested at 10% flowering

- 4 replicates **lucerne + biochar**
  - Cultivated to plant crop
  - Harvested at 10% flowering


12


FOR LIFTING-USE
SPREADER BEAM


12


HYNDS
HYNDS

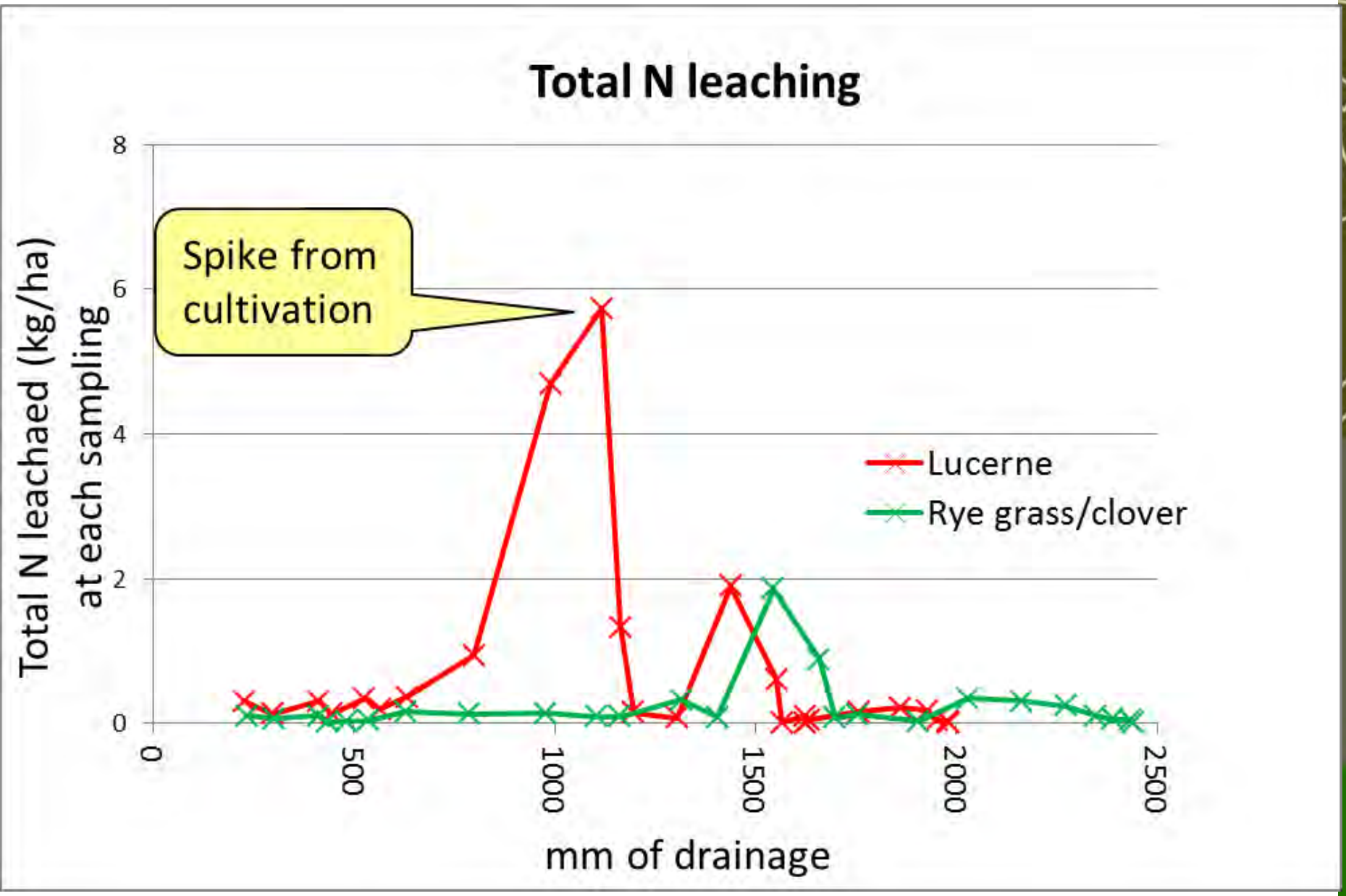

HYNDS


ftp:ftp//landcareresearch.co.nz/mcleodm/Cam_1.jpg

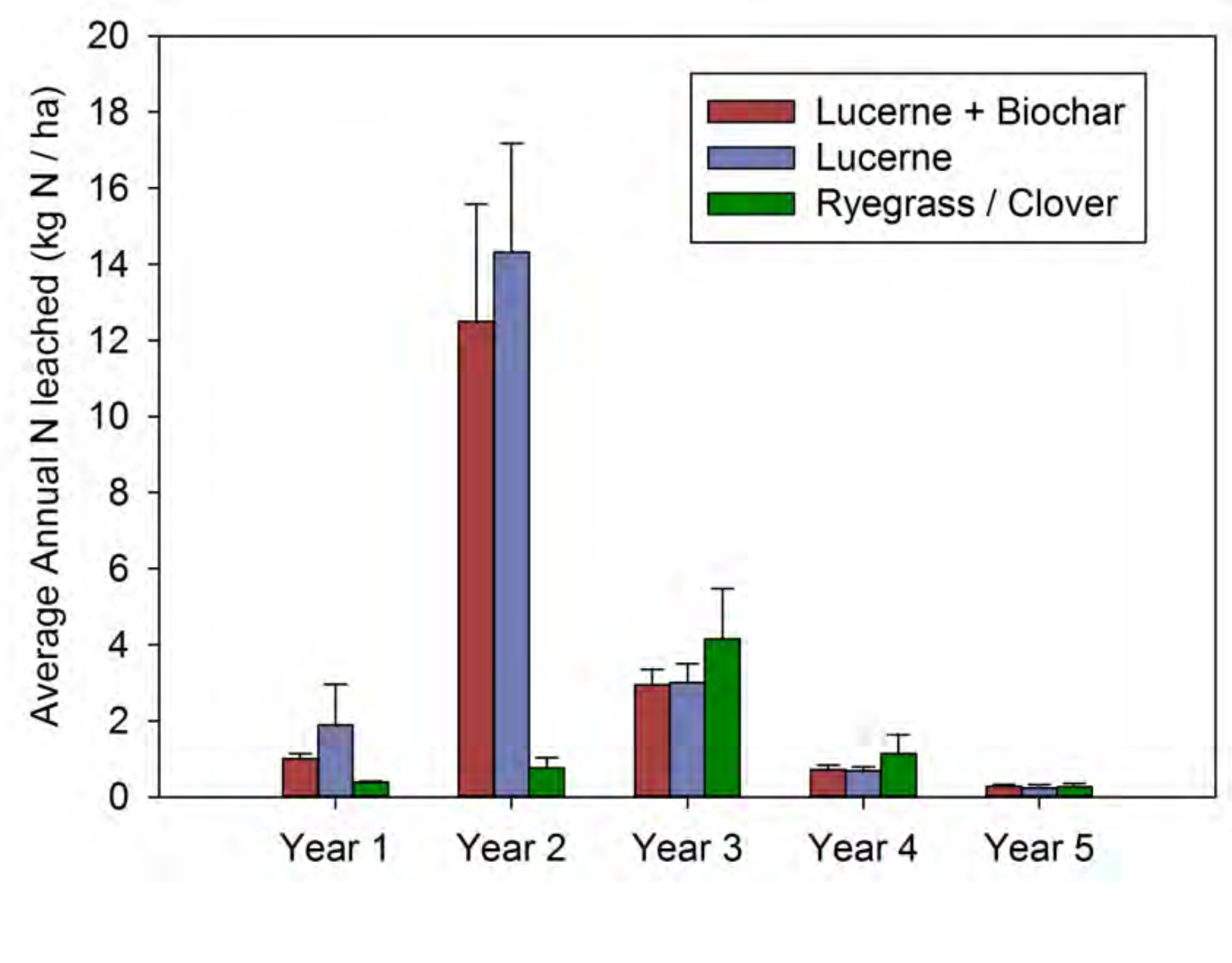

4
11
8
6
10
4
11
8
6
1
5
3

Ryegrass/clover

Lucerne



After the cultivation peak lucerne and ryegrass/clover similar


Average Annual N leached (kg N / ha)
0
2
4
6
8
10
12
14
16
18
20
Lucerne + Biochar
Lucerne
Ryegrass / Clover
Year 1
Year 2
Year 3
Year 4
Year 5

We know

- There were no significant differences in annual N leaching between lucerne and ryegrass/clover treatments for year 1 of the study

We know

- In year 2 a pulse of N was present in the leachate from lysimeters cultivated and planted in lucerne which was not present in the lysimeters containing established ryegrass/clover.

- This pulse is likely to be from the soil disturbance involved in cultivation itself and not directly from the lucerne.

We know

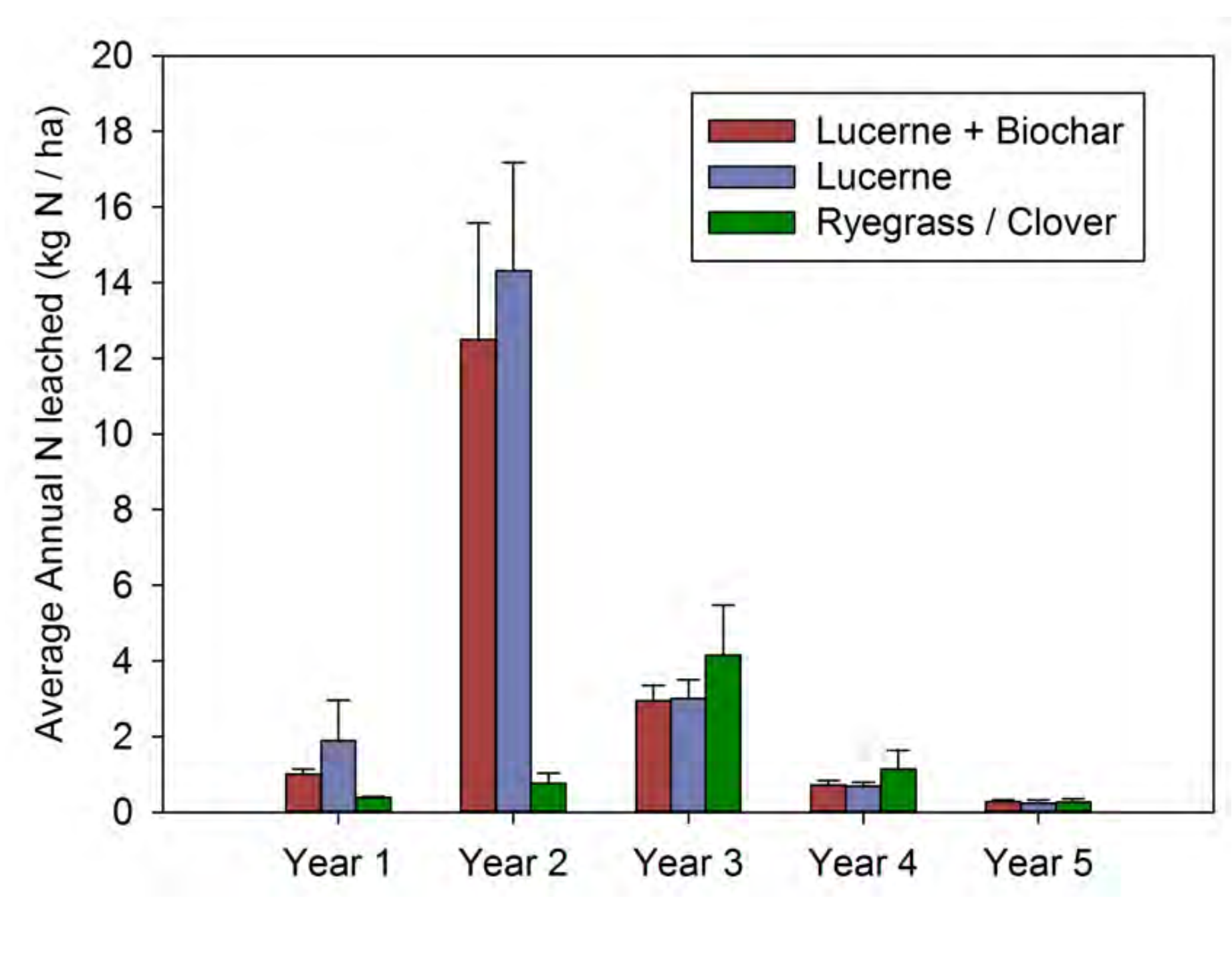
- The average annual N leaching rate for lysimeters planted in lucerne for year 2 was 13.4 kg N/ha

- The pulse of N from cultivation was short lived and for years 3–5 of the study there was again no statistical difference in annual leaching rate between treatments. Annual N leaching rates for these years varied from 0.27 to 4.15 kg N/ha.

We know

- Lysimeters planted in lucerne extracted more soil water than those with established ryegrass/clover pasture.

- This likely allowed the lucerne to continue growing while the adjacent pasture had dried off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16
18
20
Year 1
Year 2
Year 3
Year 4
Year 5
Lucerne + Biochar
Lucerne
Ryegrass / Clover

Future work

- What happens under grazing?
  - We can't put more than 1 urine patch on current lysimeter types
  - Need lots of reps to simulate 4 grazings
- Autumn is the dangerous urine patch

- Or 1.8 m diameter lysimeters so can separate urine patches and get all seasons

Thanks
LTPT and SFF for funding the work
Taupo Lake Care for hosting the SFF grant
Mike and Sharon Barton (landowners) for ongoing input
Pioneer seeds for the lucerne
Genetic Technologies for fertiliser advice
Bowers Concrete for water tank
Digger operator Darrin Sherlock for keeping us safe

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If you want to undertake research
at the facility, there is plenty of room