Pastoral 21
Canterbury site summary

Aim of the Canterbury trial

In Canterbury, the targets were to:

- Increase production from approximately 1500 kg MS/ha (Canterbury benchmark) to 1600-2200 kg MS/ha.
- Increase operating profit from $3300/ha (Canterbury benchmark) to $4300-$4800/ha (using a milk price of $6.30/kg MS).
- Reduce nitrate leaching from around 45-50 kg N/ha (for milking platform and wintering, Canterbury benchmark) to 25-35 kg N/ha (milking platform re-design and wintering strategies) and hold P leaching losses at 1 kg/ha.

Two possible directions for future Canterbury dairy farms were compared.

The first (called HSE) followed an historical trend of increasing milk production by increasing inputs, with good management practices.

- 300kg N fertiliser per hectare was applied to pasture
- 20% of total feed required for lactation was imported
- Stocking rate increased to 5 cows/ha (2500kg liveweight/ha)
- Rigorous pasture and animal monitoring and decision-making was applied to convert inputs to milk.

In the absence of DCD, it was not expected that this system could achieve N leaching losses required by future regulation.

The second direction (called LSE) sought to reduce N leaching by reducing total inputs of N fertiliser and feed on the milking platform.

- 95% of feed required for lactation was supplied by grazed pasture limit of 150kg N fertiliser per hectare.
- Stocking rate was held at the Canterbury regional average (in 2011) of 3.5 cows/ha (1800kg liveweight/ha).
- A strong focus on pasture monitoring and allocation was implemented to achieve high levels of pasture utilisation and efficiency of use of the limited amount of N fertiliser to grow grass.

The two directions were also compared to the Lincoln University Demonstration Farm (LUDF), as an intermediary.

Table 1: Farmlet details for HSE and LSE farmlets (start date 1 September 2011) - Canterbury.

	LSE	LUDF	HSE
Stocking rate (cows/ha)	3.5	3.9	5.0
N fertiliser (kg N/ha)	159	313	304
Total feed offered (t DM/cow)	6.2		6.0
Imported feed offered (t DM/ha)[1]	0.9	1.7	1.0
Comparative stocking rate (kg LWT/t DM offered	83	79	94
Winter feed	Kale		

[1] Excluding winter feeding

1. Three wintering strategies were also considered: Kale sown in October, as per common farm practice (2011), and straw offered as a supplement during feeding.
2. Kale sown in late November, followed by an oats crop which was harvested as green chop then used the following winter as supplement.
3. Fodder beet sown in October with pasture silage offered as a supplement during feeding.

Key findings

The LSE approach was shown to reduce N leaching compared to LUDF and HSE by 60% and 35% respectively, while achieving similar profits to LUDF and HSE at a milk price of $6.30. The $6.30 mark was the tipping point - above this HSE had a great profit.

1. Milking platform (Table 2)

Profit

At ~ $6.30/kg MS, all three systems were similar in profit – LUDF ahead by $100-200/ha (Table 4).

Around $6.30/kg MS appears to be the tipping point for profitability between LSE and HSE, with LSE having a better profit margin at lower milk payouts, than HSE.

Physical production

Results from three lactation seasons show that LSE:

- Produced 8% more MS/cow/yr than the HSE farmlet and 9% more than LUDF, due to more days in milk and an extra 0.2 t DM/cow feed offered.
- Produced less milk per/ha than LUDF and HSE
- Harvested 1.8 t DM/ha less pasture than HSE

N leached

- Compared with LSE, HSE had a higher N surplus – nearly 200 kg/ha. Much higher N use efficiency in LSE (48% of N used to grow all feeds on MP and wintering area, plus N imported in feeds, was exported in milk in LSE, versus 28% in HSE).
- Compared with LSE, N leached in HSE was 35% higher and ~60% higher in LUDF. Major gains in footprint available moving from LUDF to LSE.

Table 2: A summary of production from the LSE and HSE systems and comparison with performance of the LUDF, as an average of three seasons (2011/12-2013/14). A similar level of feed offered per cow in winter has been assumed for all three systems for the purposes of the comparison.

	LSE	HSE	LUDF[1]
MS produced (kg/cow/yr)	510	476	
MS produced (kg/ha/yr)	1782	2355	1821
Days in milk	270	254	268
Pasture growth (t DM/ha/yr)	16.6	18.1	17.7
Pasture eaten (t DM/ha/yr)	15.1	16.9	16.3
Pasture utilisation (%)	91%	93%	92%
N fertiliser on pasture (kg N/ha/yr)[1]	151	299	313
Silage made on farmlet (kg DM/ha)	325	0	
Silage feed (t DM/ha/yr)	740	2103	
Grain fed (t DM/ha/yr)	71	3380	
Average cow live weight (Dec)	507	499	
Comparative stocking rate (kg lwt/t DM)	82	84	
N leached milking platform (kg N/ha[2]	34	46	57
Estimated OP ($/ha/yr) @ $6.30/kg MS	4205	4345	4395
@ $5.25/kg MS	2432	1770	
@ $4.40/kg MS	970	-158	

[1] Operated with an additional 0.44 cows per hectare and an additional 200kg N/ha as fertiliser.

[2] Note, estimated using Overseer 6.2.

2. Wintering

- Across all three years of the trial the fodder beet and kale plus oats produced more DM/Ha than the tradition wintering on kale only option.
- All three options achieved body condition score gain in the range of 0.61 to 0.76 (data not shown), with fodder beet having the highest consistent gain of between 0.7-0.76 over 60 days.
- N leaching was estimated to be less under fodder beet than kale plus oats at 145kg N/ha and 180kg N/ha respectively. Direct in crop measurements via suction cups samplers (not reported) repeated this trend at 60 and 80 kg N/ha per year for fodder beet and kale plus oats respectively.

Table 3: Annual yield (t DM/ha) of crops grown in a kale-only, or a sequence cropping system.

	Winter 2012	Winter 2013	Winter 2014	Estimated N leaching N/ha[1]
Fodder beet	17.3	21.6	20.8	145
Kale-only	14.7	14.1	11.5	
Sequence cropping				
Kale	14.3	12.2	9.5	
Oats	7.7	5.3	9.7	
Total	22.0	17.5	19.2	180

[1] Note, estimated using Overseer 6.2.2.

3. All hectares (Table 4)

- The Canterbury trial also considered the impact of the whole business, by combining wintering and the milking platform. Noting that analysis includes area for replacement animals (=30-40% of the support land required).

When accounting for all land used for production:

- Both LSE and HSE came in under the original target N leaching target (35 kg N/ha), but HSE has a profit disadvantage at milk price <6.30/kg MS.
- MS produced per ha is greater for LSE than HSE, as opposed to milking platform only.
- N leaching is the same for LSE and HSE per ha and on milking platform LSE leached less than HSE/ha. The reason being HSE uses proportionately more land (purchased grain and silage, and for replacement stock), diluting the impact of the high N leaching on the platform.

- N leaching with fodder beet is less than with kale – due to higher crop yield for fodder beet, resulting in less land required for wintering, and Overseer predicts lower direct losses under fodder beet.

Table 4: All hectares counted. Note that the results have been scaled to 160ha milking platform, using all inputs plus management practices from farmlets.

	Kale plus oats		Fodder beet	
	LSE	HSE	LSE	HSE
Milking platform area (ha)	160	160	160	160
Total herd size at peak (no. of cows)	560	800	560	800
Additional support area required (ha)	125	265	127	279
Total area used for production (ha)	285	425	287	439
Milksolids (kg/ha)				
Milking platform only	1782	2355	1782	2355
Total area for production	1000	888	994	867
N leached (kg/ha)				
Milking platform only	32	46	32	46
Total area for production	45	44	30	29

How were these results achieved?

Efficient use of Fertiliser

148 kg/ha and 162 kg/ha less N fertiliser was applied on the LSE farmlet than on the HSE farmlet and LUDF respectively.

With less N fertiliser the LSE farmlet only applied fertiliser when there was feed deficit and the weather allowed, which required regular pasture walks to detect deficits as much as possible in advance.

In this way N fertiliser was used as a cheap form of supplement.

Maintaining per hectare production

The LSE farmlet produced 34kg MS/cow/yr more than the HSE farmlet. To achieve this the farmlet:

- Increased intake per cow by an estimated 0.2 t DM feed/yr
- Culled and dried off later resulting in 16 extra days in milk
- Used a high standard of pasture management (weekly farm walks, SPR, 1500-1600kg DM/ha residuals) as a lower stocking rate can result in higher grazing residuals, and impact on pasture quality.
- Accurately identified and harvested surplus grass into good quality silage
- Focused on appropriate drying off decisions including body condition score targets and APC at calving.