Dr James Hills
Pieter Raedts
AP Richard Rawnsley

Tasmanian Institute of Agriculture

Dairy Australia

Dairy HIGH 2 -

Farmlet Study

Aim: To achieve 2000kg MS/ha and 20T pasture DM/ha with 150kgN/ha

Strategy: Increase species diversity and biological N fixation (i.e., legumes)

Key measurements:

- Pasture grown and utilised (t DM/ha)
- Pasture species composition and nutritive value
- Milk solid production (kg/ha)

Dairy HIGH 2 – Treatments

Farmlet	Urea rate (annual)	Pasture composition (% on a DM basis)	Pasture design features
1	300 kg N/ha	80% grasses (perennial ryegrass) 20% legumes (white clover)	Industry standard mixture
2	150 kg N/ha	80% grasses (perennial ryegrass) 20% legumes (white clover)	Industry standard mixture
3	150 kg N/ha	40% grasses (perennial ryegrass) 30% legumes (white clover) 30% herbs (plantain)	Significant biological N fixation (legumes) Low bloat risk (condensed tannins in plantain) Reduced environmental nitrogen losses (plantain)
4	0 kg N/ha	40% grasses • 20% summer-active tall fescue • 10% perennial ryegrass • 5% summer-active cocksfoot • 5% brome 30% legumes • 30% clover (red, strawberry & white) 30% herbs (plantain & chicory)	Significant biological N fixation (legumes) Low bloat risk (condensed tannins in plantain) Reduced environmental nitrogen losses (plantain) High species diversity (9 species) Deep-rooted species (tall fescue, plantain and chicory)

Dairy HIGH 2 – Treatments

Each farmlet consists of 8 x 0.92-ha irrigated paddocks

Farmlets 1-3 had 29 cows (4 cows per Ha

Farmlet 4 had 22 cows (3 cows per Ha)

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Timeline of major activities

Dairy Australia

March 2021	Grided soil sampling	40x57.5m to 200mm depth
April 2021	Initial groundwork Soil amendment	Tilled to 75mm and ploughed to 200mm 7.6t lime 170kg P/ha (Pasture King) 98kg K/ha (Muriate of Potash)
May 2021	Planting	Italian Ryegrass cv Concord

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Timeline of major activities

Dairy Australia

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Timeline of major activities

Dairy Australia

Sept to Dec 2021	**Grazing and silage**	
January 2022	**Installing irrigation**	
Feb 2022	**Fertiliser application – 1 Groundwork**	**K, P, S and Micros Double disking to approx. 20cm**
March 2022	**Planting farmlet paddocks**	**Seed drill (Sulky Burel)**

F4 : Grass Mix @ 13 kg/ha [54% Tall Fescue cv. Quantica, 27% Perennial ryegrass (cvv. Base & Impact 2 in 60:40 ratio), 11% Coloured brome cv. ExcelTas & 8% Cocksfoot cv. Aurus] & Legume/Herb Mix @ 13 kg/ha [31% White clover (50:50 Legacy & Quartz mixture), 23% Red clover cv. Amigain, 4% Strawberry clover cv. Palestine, 38% Plantain cv. EcoTain & 4% Chicory cv. Puna II)

F3: Grass Mix @ 11 kg/ha (Perennial ryegrass cvv. Base & Impact 2 in 60:40 ratio) & Legume/Herb Mix @ 11 kg/ha [70% White clover (50:50 Legacy & Quartz mixture) & 30% Plantain cv. EcoTain]

F1 and 2: Grass Mix @ 22 kg/ha (Perennial ryegrass cvv. Base & Impact 2 in 60:40 ratio) & Legume Mix @ 4 kg/ha (White clover cvv. Legacy & Quartz in 50:50 ratio)

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Timeline of major activities

Dairy Australia

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Timeline of major activities

Dairy Australia

May 2022	**Decision to terminate clover**	**Broad leaf weed issue**
June to September 2022	**Broadleaf spray program**	
Sept to Oct 2022	**Preparation for resowing clover**	**Mulching raking and grass removal**
November 2022	**Maintenance fertiliser application 2**	

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Timeline of major activities

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Timeline of major activities

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Timeline of major activities

Dairy Australia

October 2022	Resowing Clover	F1 and 2 – 5kg/ha White Clover (Legacy/Quartz mix) F3 – 8 kg/ha White Clover (Legacy/Quartz mix) F4 – 9.5kg/ha Clover (57% white, 37% red cv Amagain and 10% Strawberry cv Palestine)
November 2022	Topping up other species	Broadcast
May 2023	Topping up ryegrass and plantain	Airseeder
July to August 2023		Selecting and introducing farmlet herds
October 2023	Topping up ryegrass plantain and chicory in some paddocks	Novag T-Forceplus 350

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Timeline of major activities

Dairy Australia

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Botanical composition

Dairy Australia

Aim at start (July 2023)

	Ryegrass	Clover	Plantain
F1	80	20	
Summer 2025			
F2	80	20	
Summer 2025			
F3	40	30	30
Summer 2025			

	Ryegrass	Clover	Plantain	Tall Fescue	Cocksfoot	Chicory	Other
F4	10	30	29	20	10	1	
Summer 2025							

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Botanical composition

and current (Jan 2025)

Dairy Australia

	Ryegrass	Clover	Plantain
F1	80	20	
Summer 2025	**69**	**28**	
F2	80	20	
Summer 2025	**73**	**26**	
F3	40	30	30
Summer 2025	**65**	**29**	**3**

	Ryegrass	Clover	Plantain	Tall Fescue	Cocksfoot	Chicory	Other
F4	10	30	29	20	10	1	
Summer 2025	**37**	**36**	**3**	**2**	**16**	**1**	**5**

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Production Results

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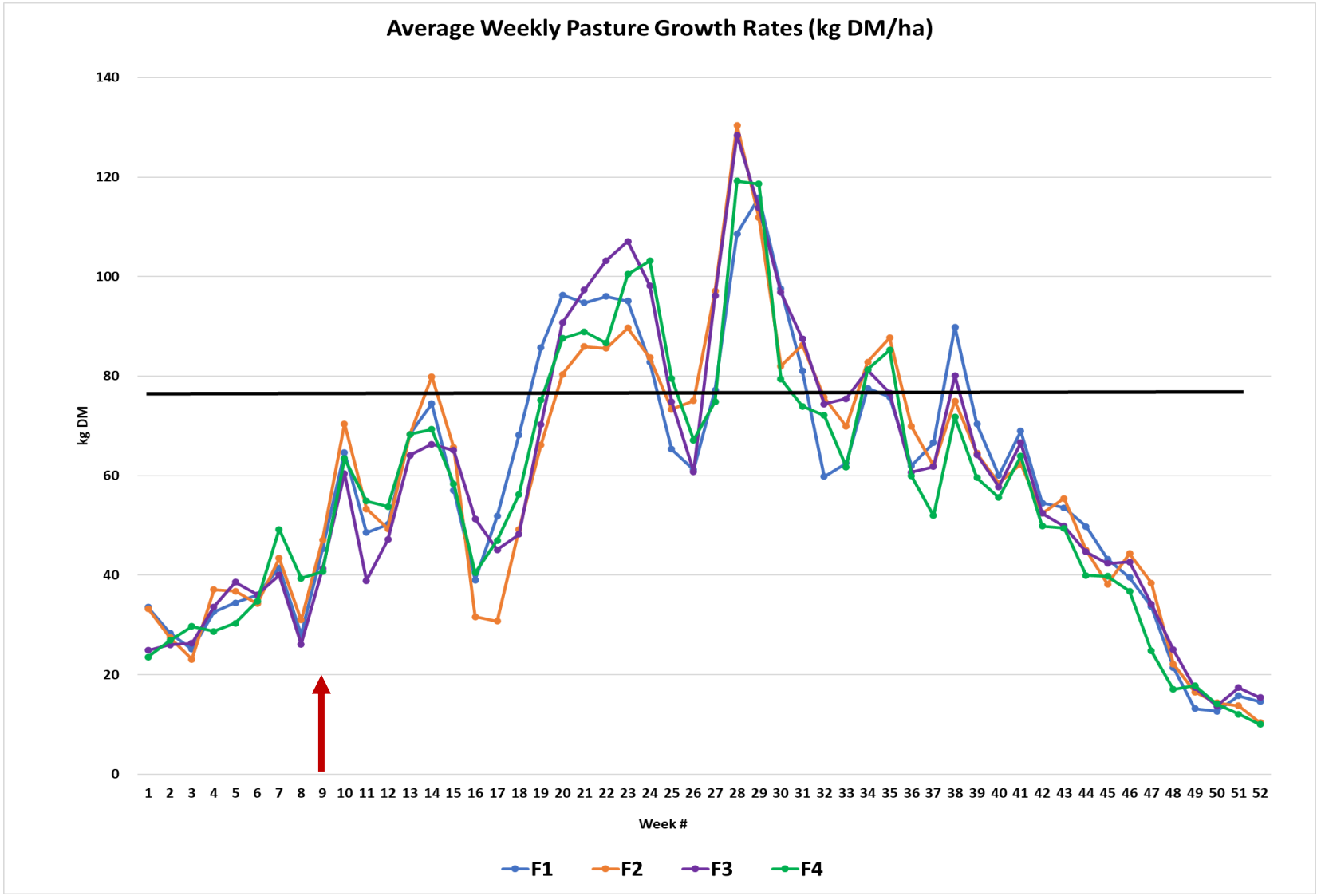
Dairy HIGH 2 - Pasture Production

2023-2024

Dairy Australia



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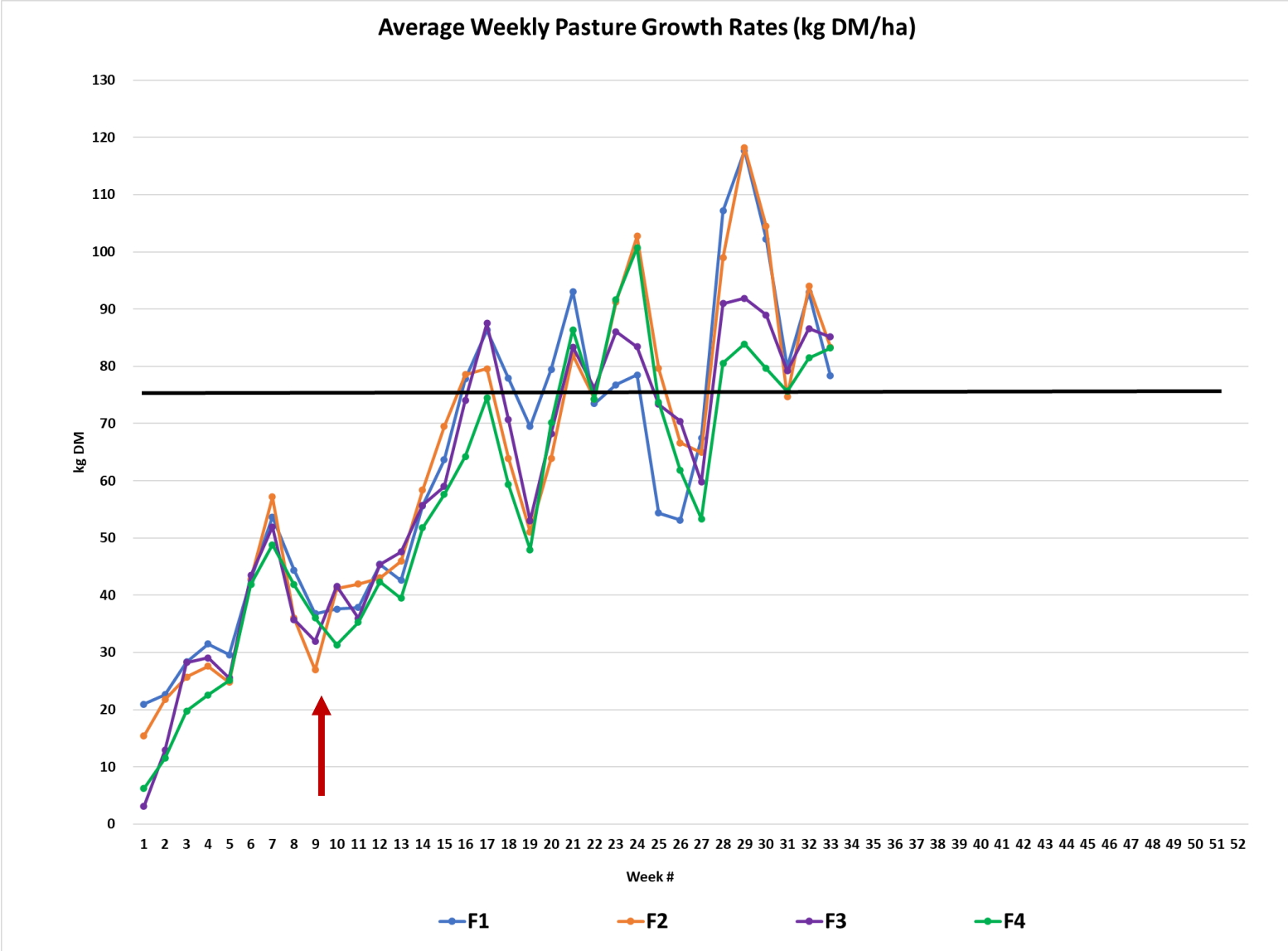
Dairy HIGH 2 - Pasture Production

2024-2025

Dairy Australia



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Dairy HIGH 2 - Pasture Production

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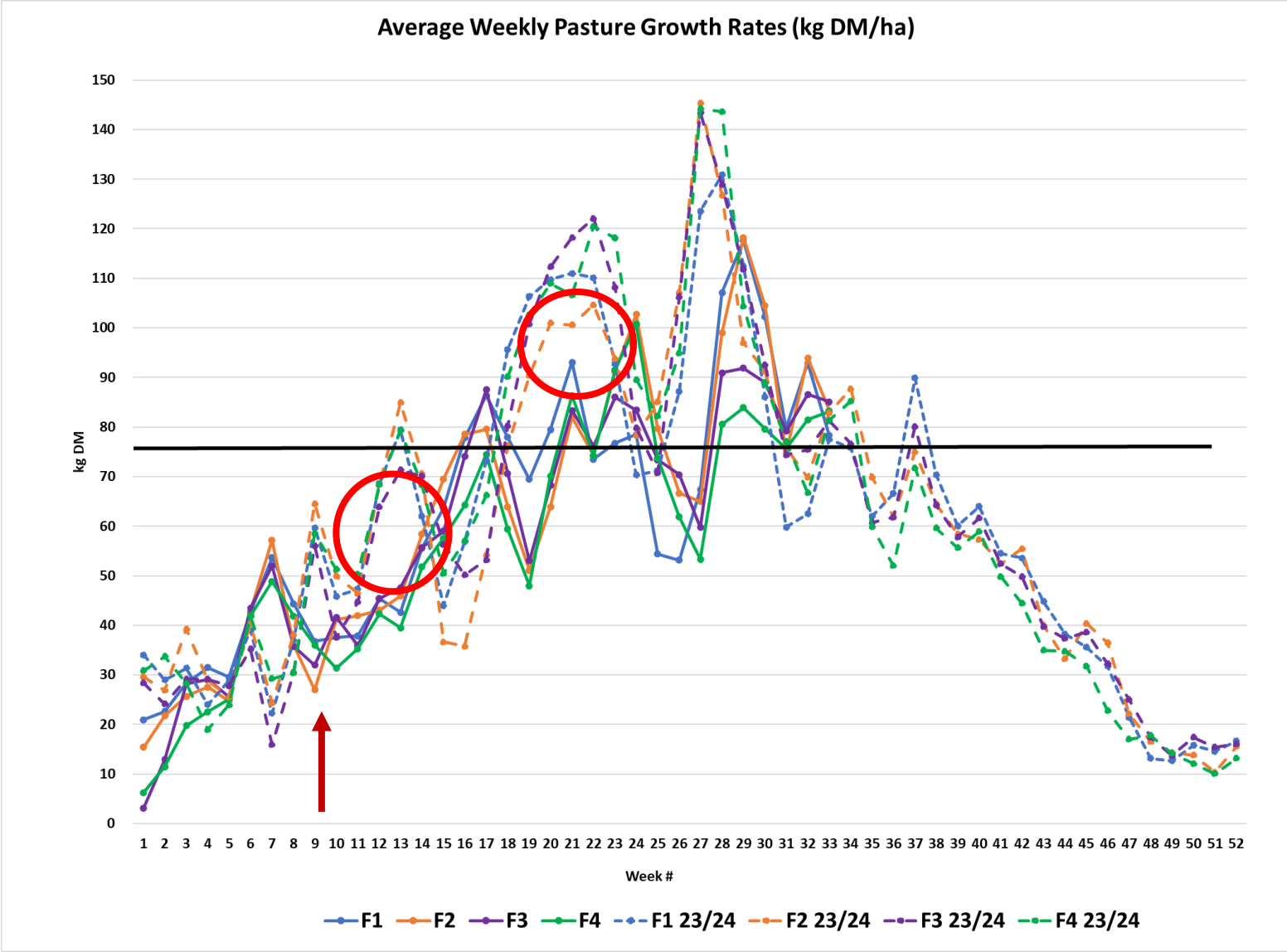
Growth rates to date



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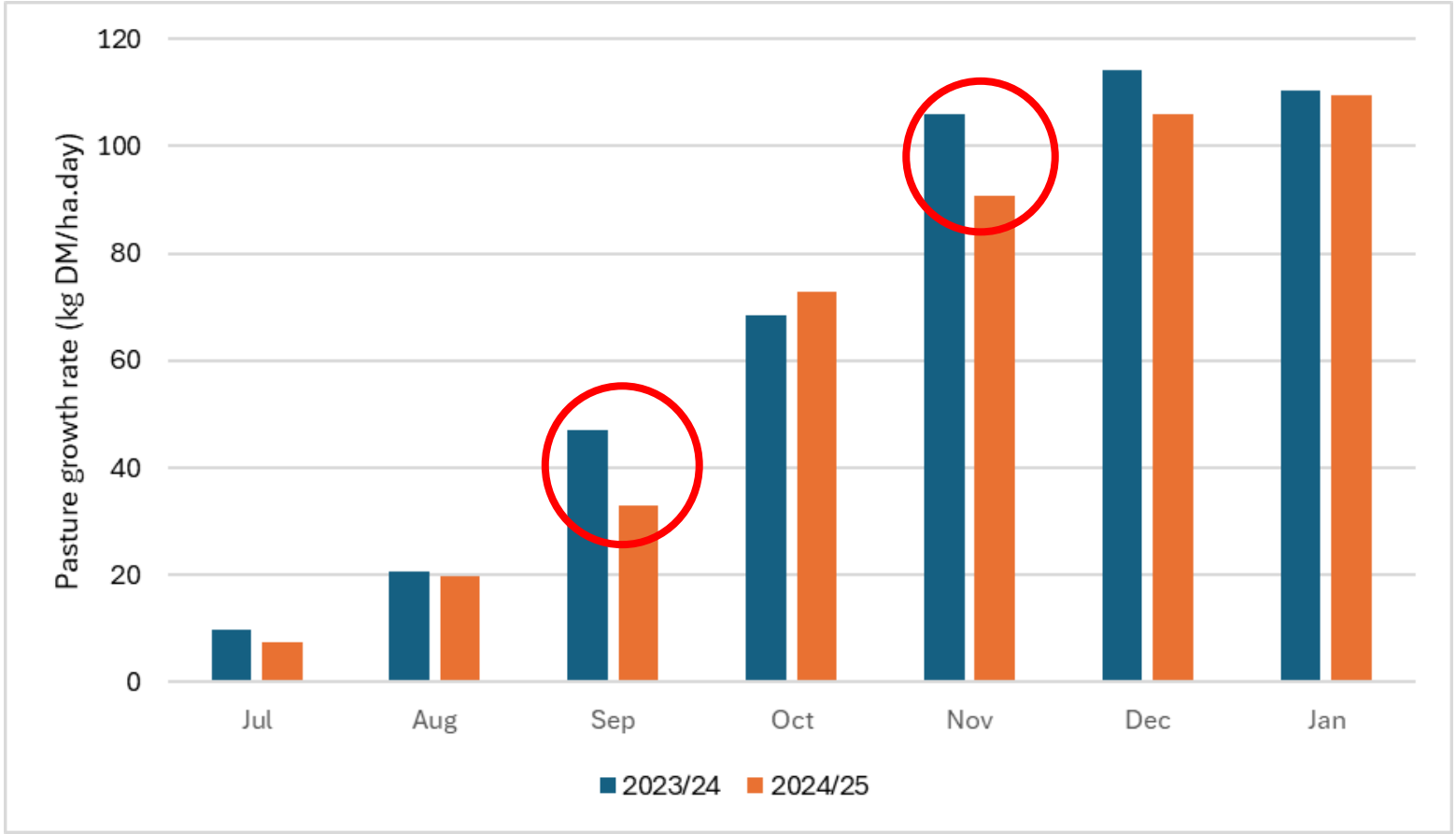
Modelled Pasture Production

Using DairyMod

Dairy Australia



Season to end of Jan: 23/24: 14.6 tonne DM; 24/25: 13.5 tonne DM

Farmlets estimate: 23/24 ±14.5 tonne DM; 24/25 ±13.7 tonne DM

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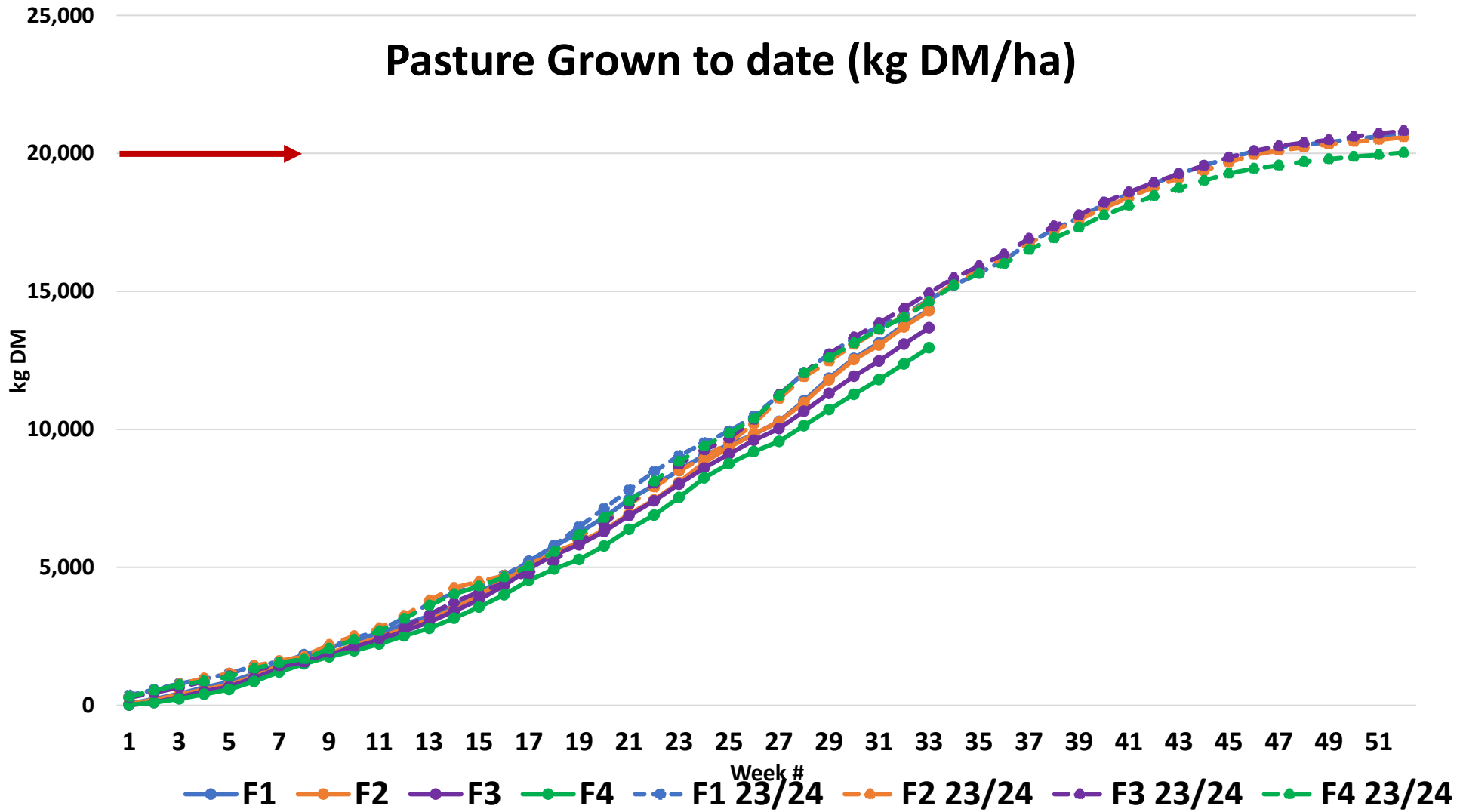
Dairy HIGH 2 - Pasture Production

Dairy Australia



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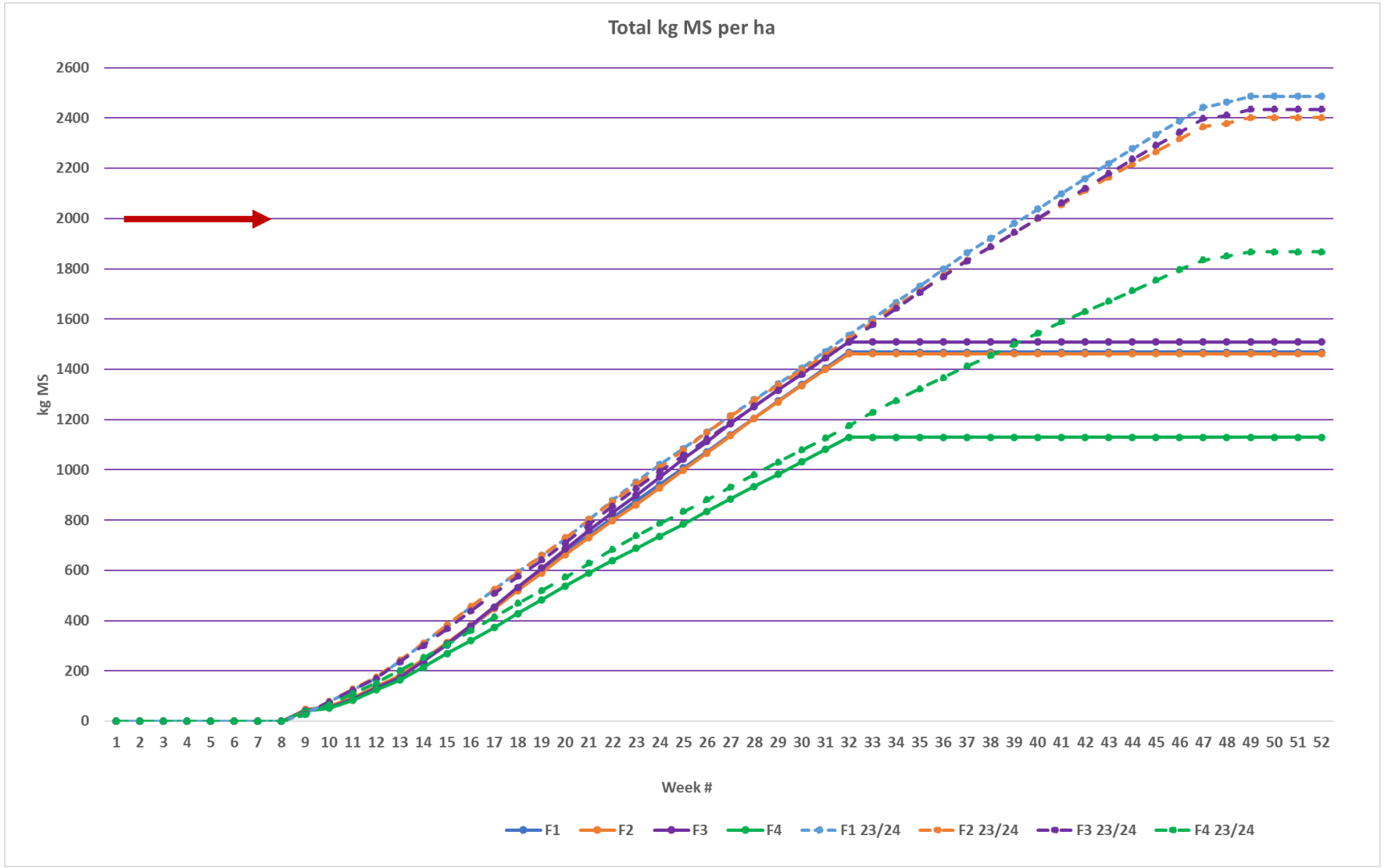
Dairy HIGH 2 - Cow Production

Dairy Australia

Current kg MS/ha - F4: lower SR; MS/cow similar



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Discussion

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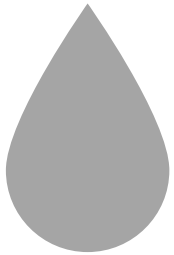
How are we achieving this production similar to modelled potential?

Dairy Australia

Removed limitations of nutrients except for N

Addressing deficiencies at establishment

Maintaining nutrients within optimum ranges through yearly soil testing and twice-yearly fertiliser applications



Removed limitations of water through appropriate irrigation

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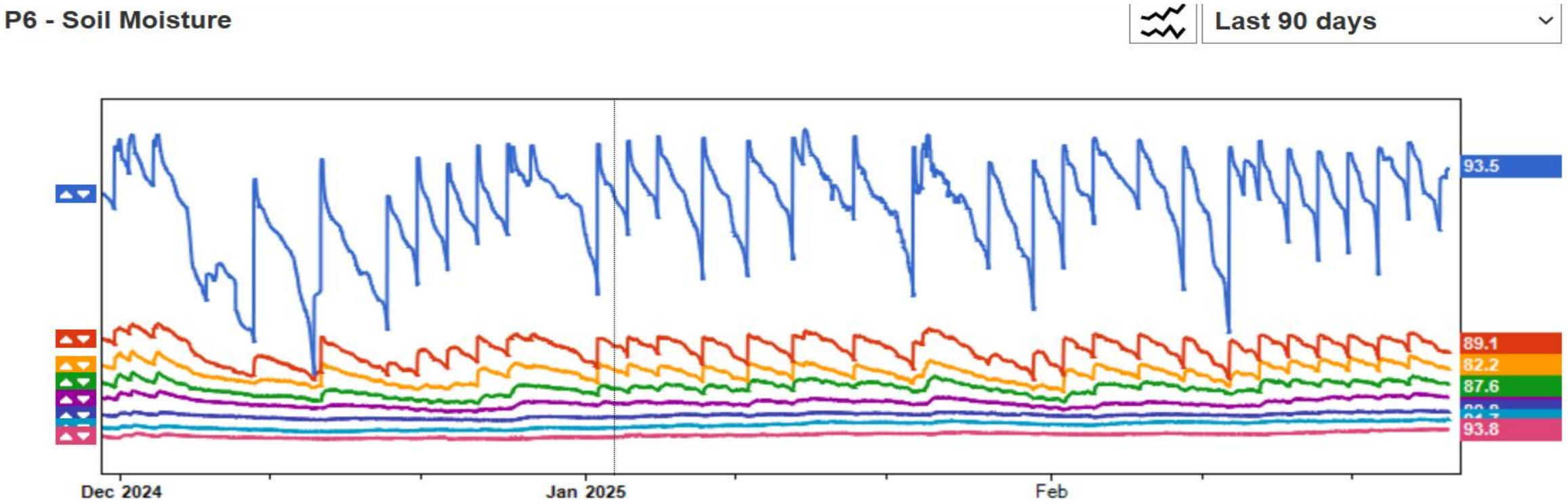
Soil Moisture

Dairy Australia



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Soil nutrient levels (10cm)

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	pH Level	Phosphorus Olsen	Potassium Colwell	Sulfur
	(H2O)	mg/kg	mg/kg	mg/kg
Mean F1	6.4	19.7	245	24.5
Mean F2	6.5	20.0	244	27.8
Mean F3	6.4	20.1	221	23.9
Mean F4	6.4	20.1	234	28.5
"ideal" levels	5.6 - 7.0	17 - 25	150 - 220	8 - 16

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What about the Nitrogen story….

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Dairy HIGH 2 - Farmlet Trial

Pasture Quality 2023-2024

Dairy Australia

Pasture nutritive quality analysis (wet chem.)

Pasture, mean results	# samples	MJ ME	CP	NDF	WSC	Ash
All	304	12.5	23.4	33.3	13.3	9.8
F1	78	12.7	23.4	34.5	14.0	9.6
F2	78	12.6	23.1	33.7	13.9	9.6
F3	76	12.5	23.6	33.1	13.3	9.9
F4	72	12.2	23.5	31.8	11.7	10.1

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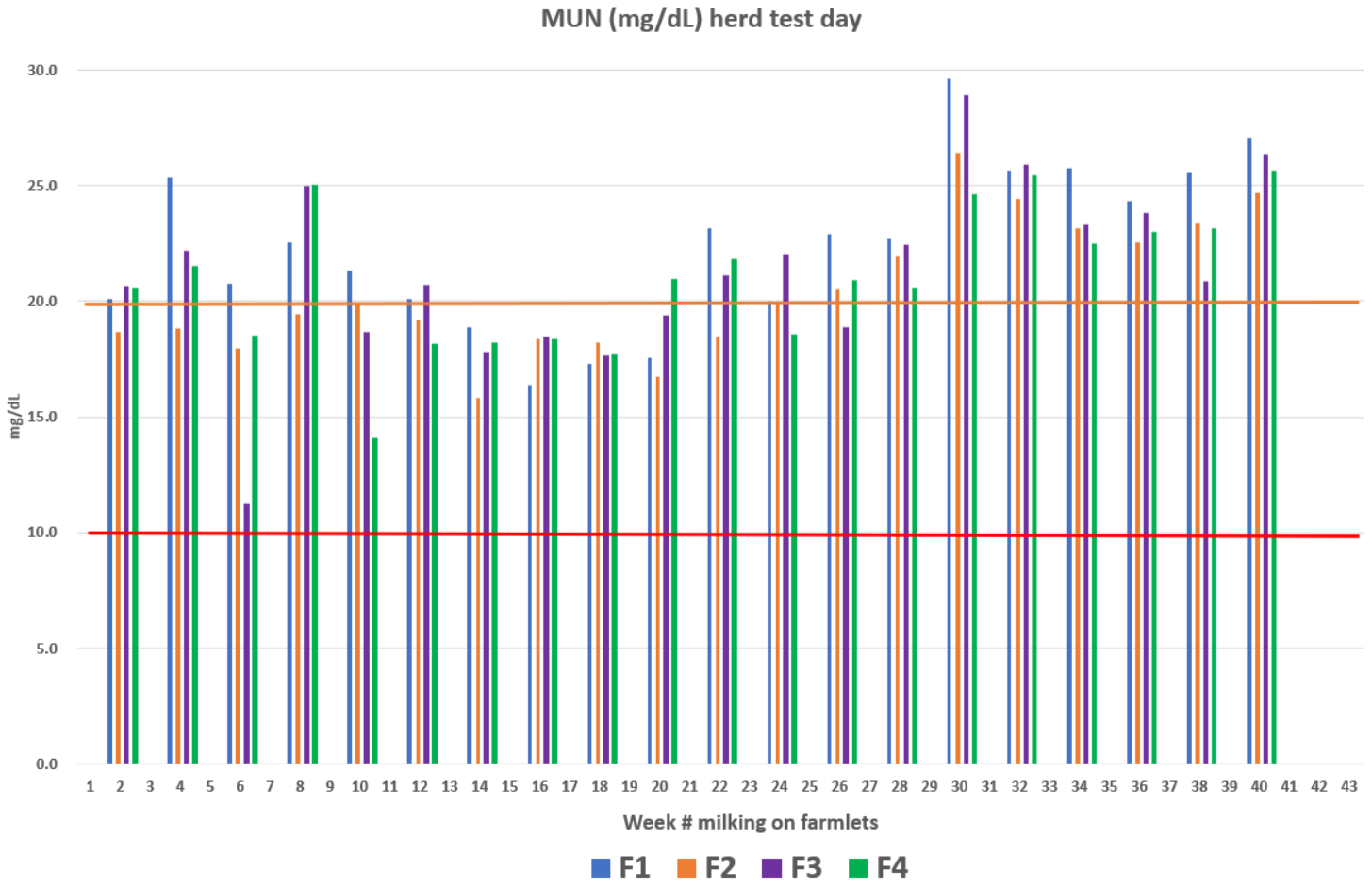
- **Milk urea nitrogen on herd test days 23/24**

- **Red and Orange line are at 10 and 20 mg/dL**



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Dairy HIGH 2 - Farmlet Trial

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Pasture Quality 2023-2024

Pasture nutritive quality analysis January 2024

ID	NDF	CP	DOMD	ME
F1 - Ryegrass	47.8	21.8	71.7	11.6
F4 - Ryegrass	48.2	19.7	70.5	11.3
F1 - Clover	25.1	28.4	79.8	13.2
F4 - Clover	28.0	27.8	77.6	12.7

Samples from 4 paddocks per farmlet combined.
CP difference between Ryegrass and Clover:
F1 = 6.6%, F4 = 8.1%

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Amount of N fixed from air: amount of clover and activity of rhizobia

Intern investigated if rhizobia in nodules were active

All Farmlets had active Rhizobia, including Farmlet 1

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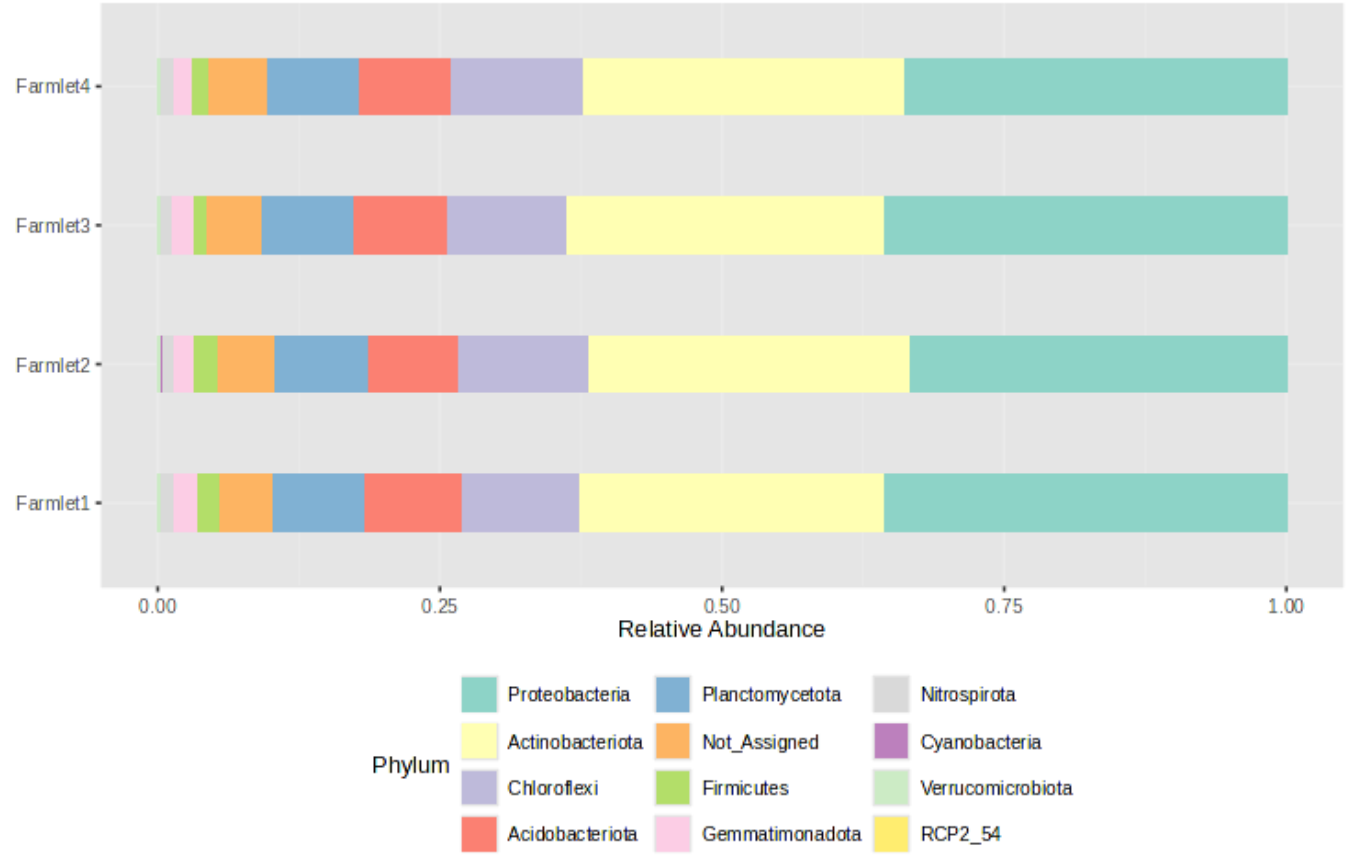
Baseline analysis of soil microbiome: bacterial community



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Presence of nitrogen-fixing bacteria

- *Allorhizobium_Neorhizobium_Pararhizobium_Rhizobium*
- *Bradyrhizobium*
- *Mesorhizobium*
- *Sphingomonas*
- *Devosia*
- *Methylobacterium_Methylorubrum*
- *Rhodopseudomonas*
- *Acidiphilium*
- *Hyphomicrobium*
- *Clostridium*
- *Bosea*

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N on Farmlet pastures, per ha per round

Dairy Australia

Indicative Estimations

Per Ha per grazing round	F1	F2 and F3	F4
CP% in pasture grazed	23.5	23.5	23.5
Kg DM/Ha grown			
Synthetic fertiliser kg/Ha			
N from cows			
Total effective N required			
N from clover and other sources			

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N on Farmlet pastures, per ha per round

Dairy Australia

Indicative Estimations

Per Ha per grazing round	F1	F2 and F3	F4
CP% in pasture grazed	23.5	23.5	23.5
Kg DM/Ha grown	1500	1500	1500
Synthetic fertiliser kg/Ha			
N from cows			
Total effective N required			
N from clover and other sources			

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N on Farmlet pastures, per ha per round

Dairy Australia

Indicative Estimations

Per Ha per grazing round	F1	F2 and F3	F4
CP% in pasture grazed	23.5	23.5	23.5
Kg DM/Ha grown	1500	1500	1500
Synthetic fertiliser kg/Ha	30	15	0
N from cows			
Total effective N required			
N from clover and other sources			

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N on Farmlet pastures, per ha per round

Dairy Australia

Indicative Estimations

Per Ha per grazing round	F1	F2 and F3	F4
CP% in pasture grazed	23.5	23.5	23.5
Kg DM/Ha grown	1500	1500	1500
Synthetic fertiliser kg/Ha	30	15	0
N from cows	23	23	18
Total effective N required			
N from clover and other sources			

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N on Farmlet pastures, per ha per round

Dairy Australia

Indicative Estimations

Per Ha per grazing round	F1	F2 and F3	F4
CP% in pasture grazed	23.5	23.5	23.5
Kg DM/Ha grown	1500	1500	1500
Synthetic fertiliser kg/Ha	30	15	0
N from cows	23	23	18
Total effective N required	56	56	56
N from clover and other sources			

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N on Farmlet pastures, per ha per round

Dairy Australia

Indicative Estimations

Per Ha per grazing round	F1	F2 and F3	F4
CP% in pasture grazed	23.5	23.5	23.5
Kg DM/Ha grown	1500	1500	1500
Synthetic fertiliser kg/Ha	30	15	0
N from cows	23	23	18
Total effective N required	56	56	56
N from clover and other sources	3	18	38

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Benchmarking - preliminary findings

Dairy Australia

Farmax

- Dairy Farm Monitor data -Tasmanian costs for Farmlets
- Benchmarked to 70 DSM farms in NZ

- Farmlets differ:
  - Labour (F4)
  - N-fertiliser
  - Fertiliser (F4)
  - Bloat drench

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Benchmarking - preliminary findings

Dairy Australia

23 24 Season					
KPI	**DSM Average**	**Farmlet 1**	**Farmlet 2**	**Farmlet 3**	**Farmlet 4**
Farm Performance					
Effective Area (ha)	278	7.36	7.36	7.36	7.36
Stocking Rate (Peak Milkers/ha)	3.37	3.93	3.93	3.93	2.98
Milk Solids (kg / ha)	**1576**	**2486**	**2401**	**2434**	**1868**
Milk Solids (kg /cow)	467	633	611	619	627
Peak Cows Milked	936	29	29	29	22
Pasture Eaten Season (t DM/ha)	**12.3**	**15.2**	**15.3**	**15.3**	**12.7**
Pasture Eaten /cow	3648	4050	4000	4080	4400
Total Supplement Offered (Cows) /cow	676	2054	1871	1867	1588
Total Feed per Cow	4323	6000	5850	5900	5980
Supplement as % of intake	**15%**	**33%**	**31%**	**31%**	**27%**
Nitrogen Use (kg N/ha)	166	268	142	144	0

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Benchmarking - preliminary findings

Dairy Australia

23 24 Season					
Financial Indices	**DSM Average**	**Farmlet 1**	**Farmlet 2**	**Farmlet 3**	**Farmlet 4**
Operating Costs ($/kg MS)	**5.13**	**5.01**	**5.05**	**5.00**	**5.18**
Milk price 7 + 0.45 Livestock etc.	7.45	7.45	7.45	7.45	7.45
Operating Profit (EFS) /kgMS	2.32	2.44	2.40	2.45	2.27
Operating Profit (EFS) /ha	**3,656**	**6,066**	**5,762**	**5,963**	**4,240**
Milk price 8 + 0.45 Livestock etc.	8.45	8.45	8.45	8.45	8.45
Operating Profit (EFS) /kgMS	3.32	3.44	3.4	3.45	3.27
Operating Profit (EFS) /ha	**5,232**	**8,552**	**8,163**	**8,397**	**6,108**
Milk price 9 + 0.45 Livestock etc.	9.45	9.45	9.45	9.45	9.45
Operating Profit (EFS) /kgMS	4.32	4.44	4.4	4.45	4.27
Operating Profit (EFS) /ha	**6,808**	**11,038**	**10,564**	**10,831**	**7,976**

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Summary

- Data to date: profitable and very productive
  - Pasture grown - in a good year 20 tonnes achievable
  - MS/ha: >2,000 kg is achievable (2,400 kg/ha for farmlets 1, 2 and 3)
  - Pasture production achieved with lower or no synthetic N/ha
  - Clover is likely to be the key driver of productivity for farmlets 2,3 and 4

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Dairy HIGH 2 - Farmlet Trial

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Scan QR code for info and updates on our Farmlet trial

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Thank you

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