

Agronomy Network

Recent and current agronomy
research (AgVic) in northern
Victoria

9 December 2016

AGRICULTURE VICTORIA



Forage Agronomy Research in northern Victoria

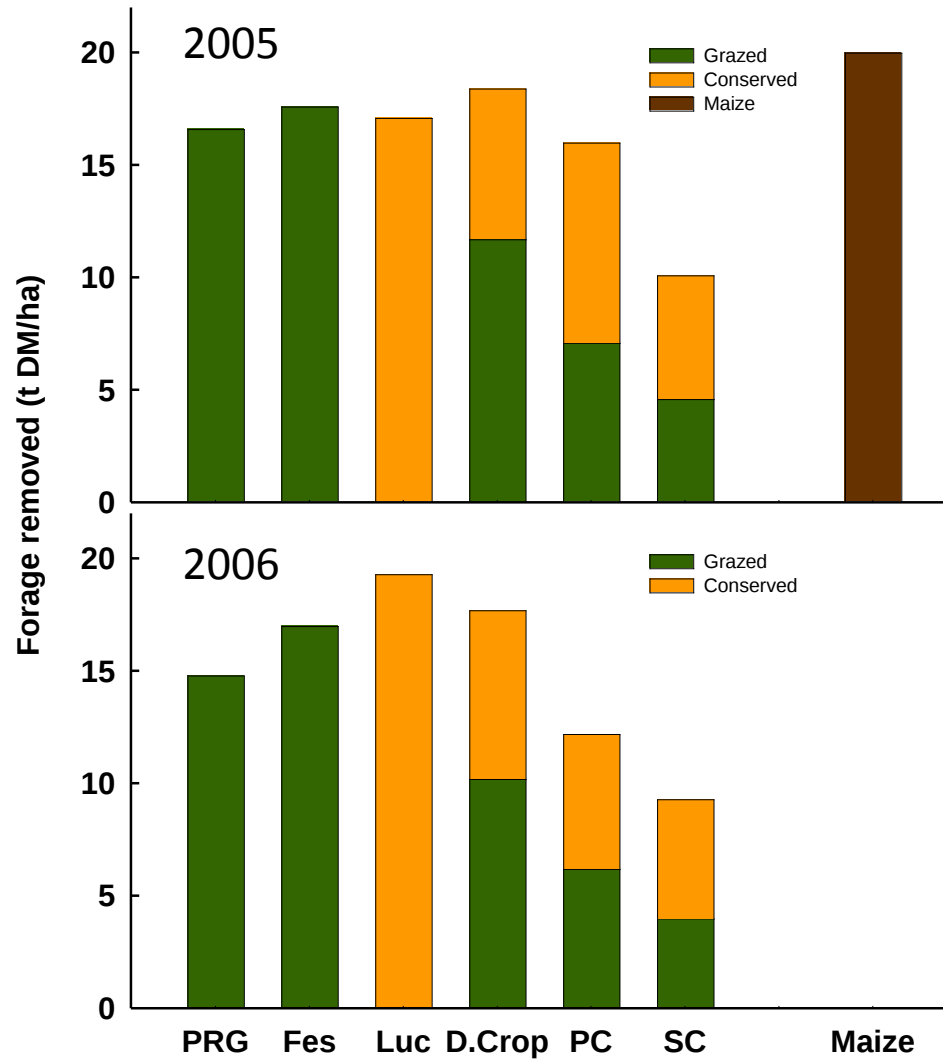
Agriculture Victoria – Dairy Australia / Murray Dairy co-funded

←	2000	01	02	03	04	05	06	07	08	09	2010	11	12	13	14	15	16	17	18
Perennial pasture renovation																			
Soil modification (forage types)																			
												Water use efficiency review (forages)							
										Water use of maize									
												Water use and productivity of forage types							
												Flexible forages (lucerne – irrigation strategy & grazing management fescue)							
														Perennial ryegrass genetic gain					
														Perennial ryegrass summer survival					
														Perennial ryegrass – endophyte					
														FVI – supplementary site(s)					

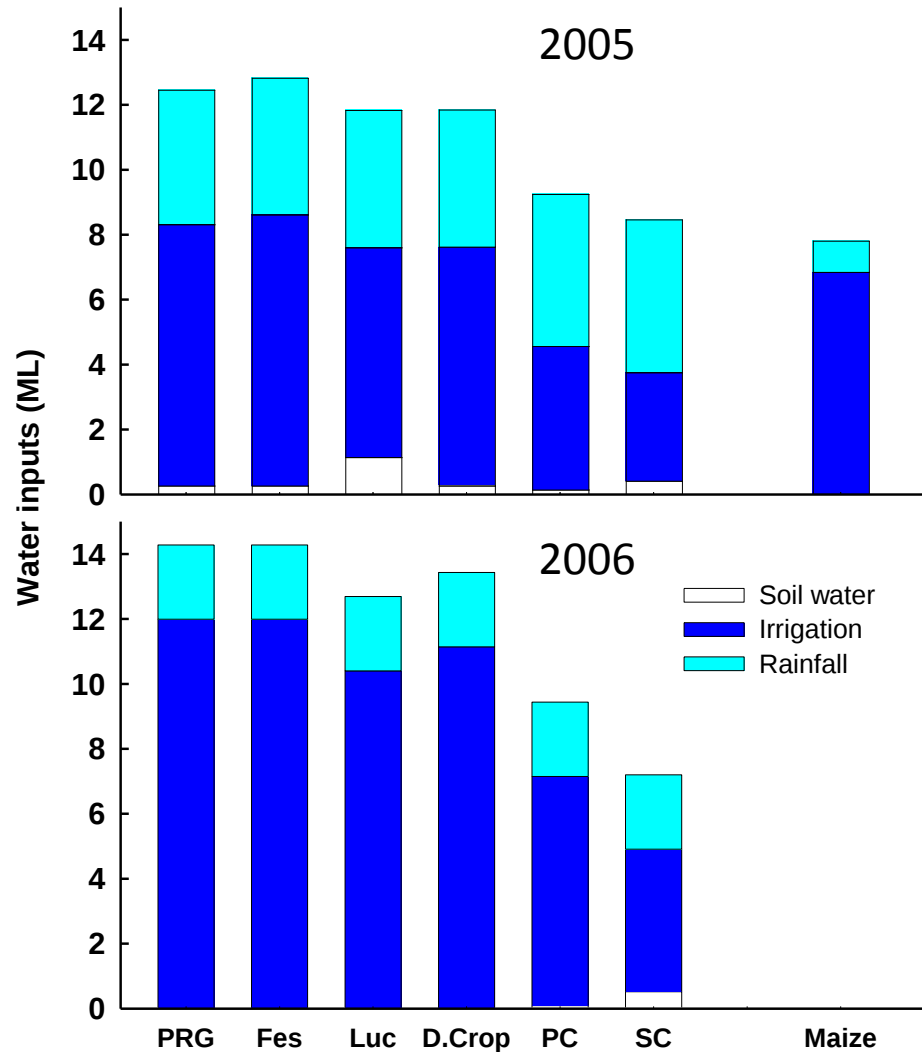
Forage system – water use and production (2004-2008)



Forage systems - production



Forage systems – water use

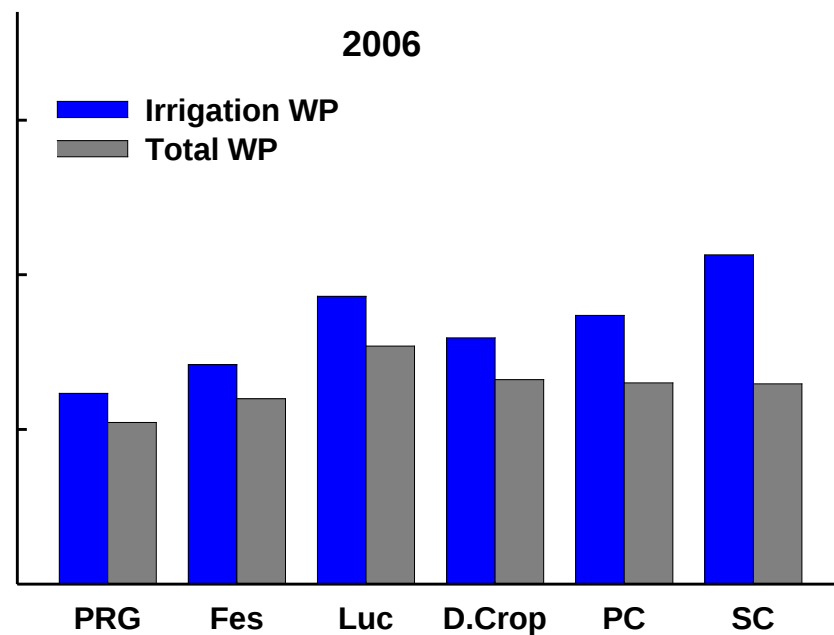
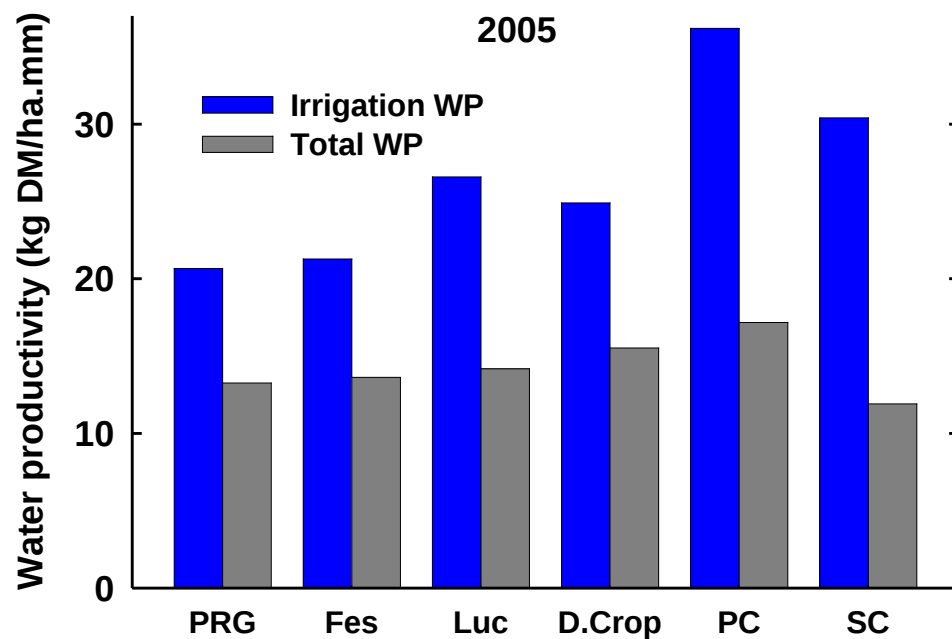


Water Productivity (WP)

$$\text{Irrigation WP} = \frac{\text{DM production}}{\text{Irrigation Water Intake}}$$

$$\text{Total WP} = \frac{\text{DM Production}}{\text{Irrigation} + \text{Rainfall} + \Delta\text{Soil water}}$$

Forage Systems – Water Productivity



Flexible forages (2008-2014)

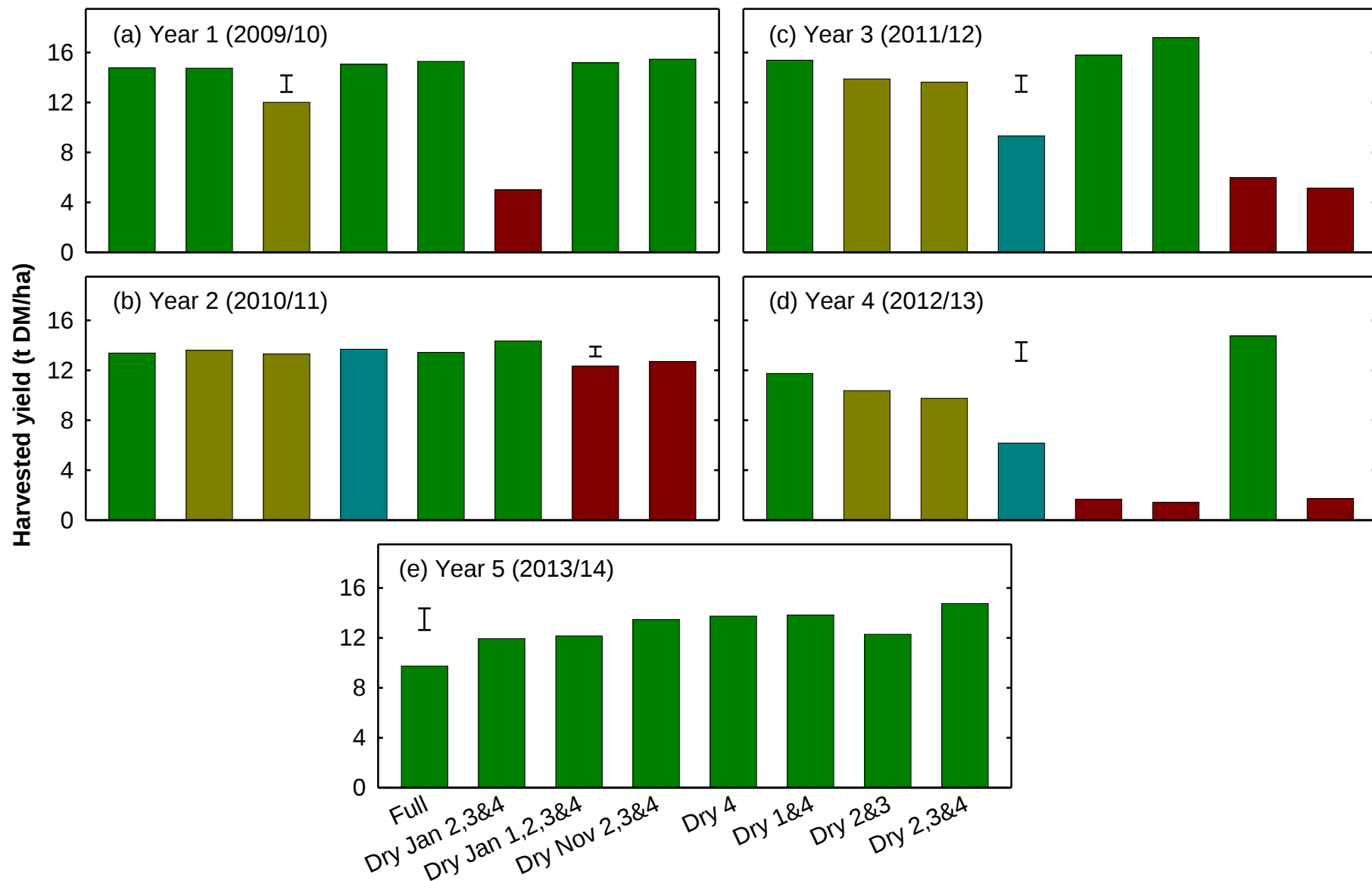
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Lucerne Irrigation Strategies

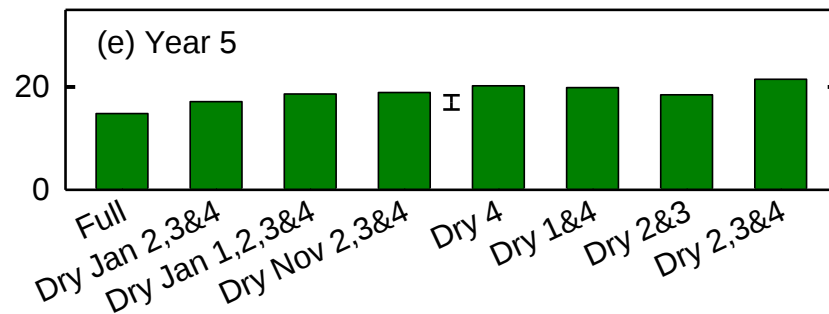
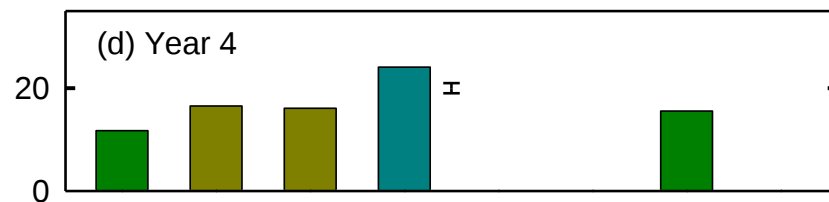
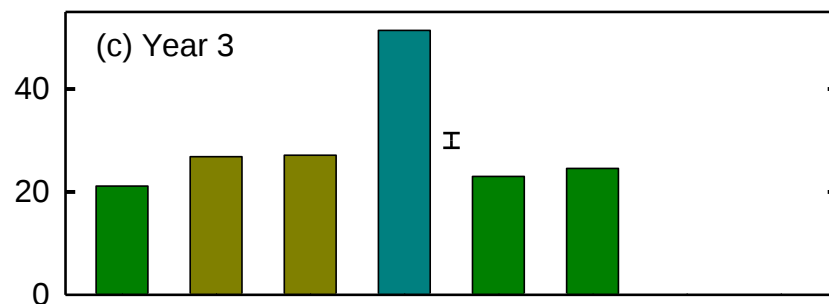
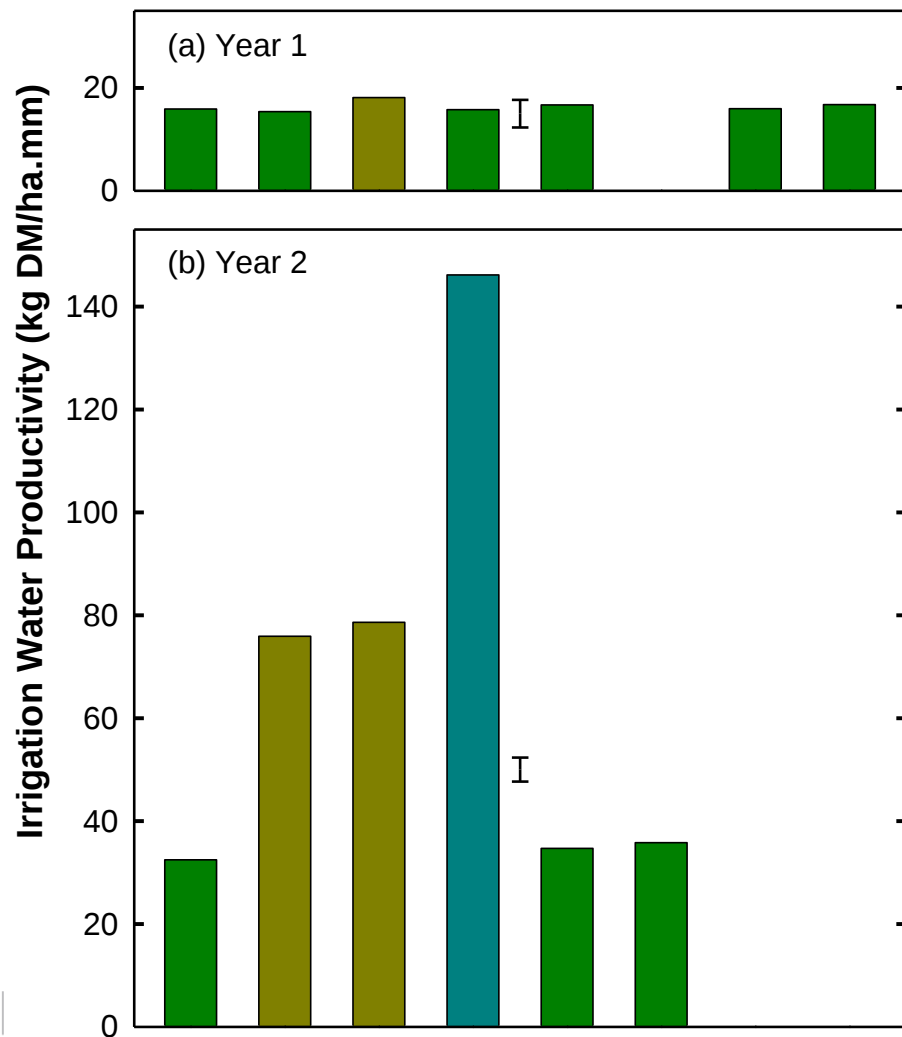
Irrigation Treatment	Year 1				Year 2				Year 3				Year 4				Year 5			
	2009/10				2010/11				2011/12				2012/13				2013/14			
	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn
Full																				
Dry Jan 2,3&4																				
Dry Jan 1,2,3&4																				
Dry Nov 2,3&4																				
Dry 4																				
Dry 1&4																				
Dry 2&3																				
Dry 2,3&4																				
SSD																				



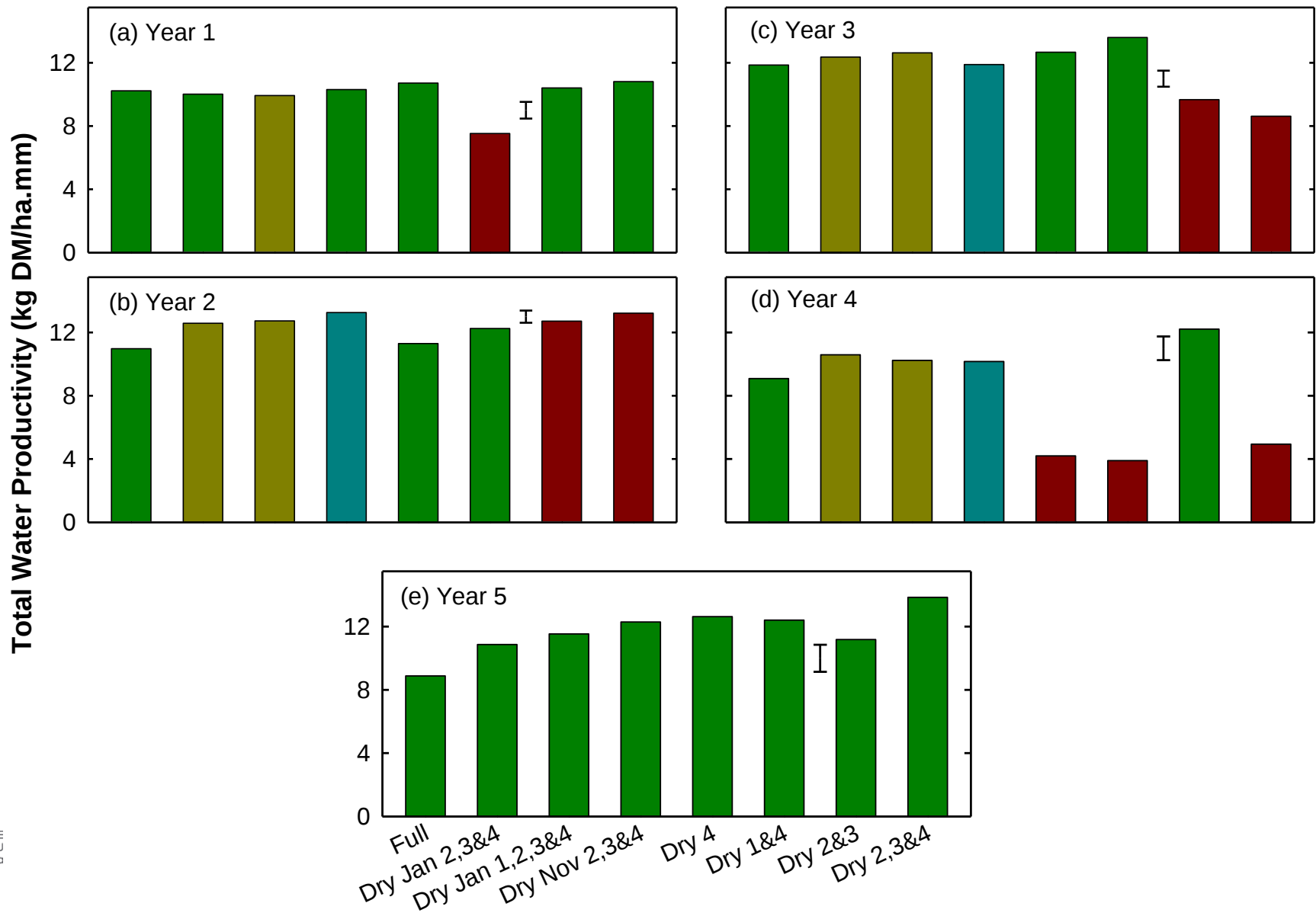
Lucerne – DM yield



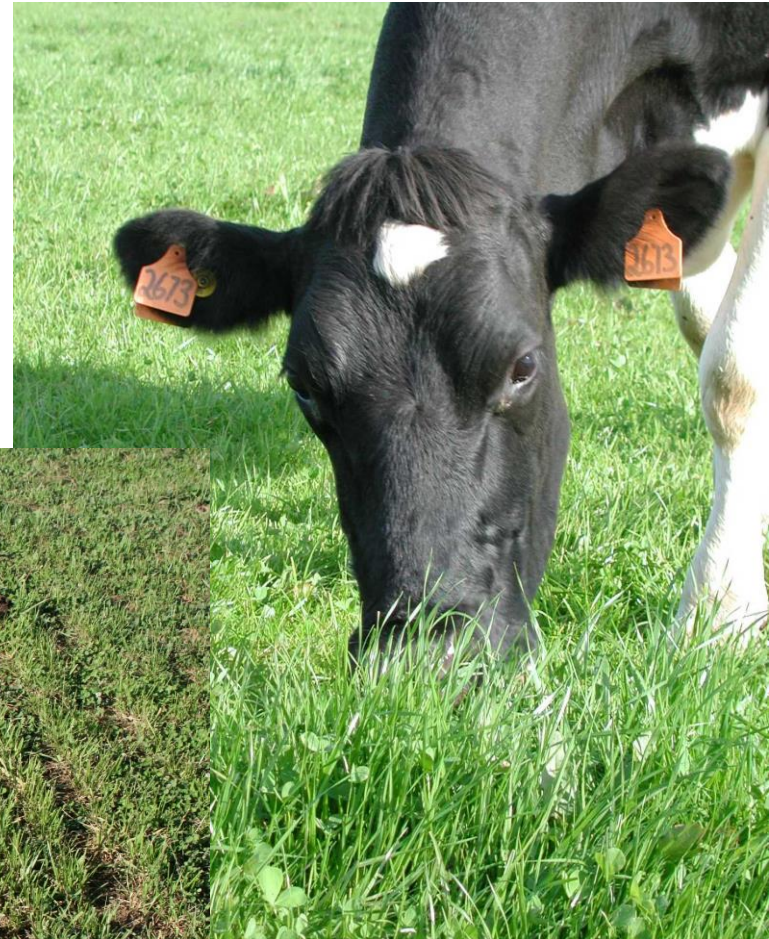
Lucerne – Irrigation Water Productivity



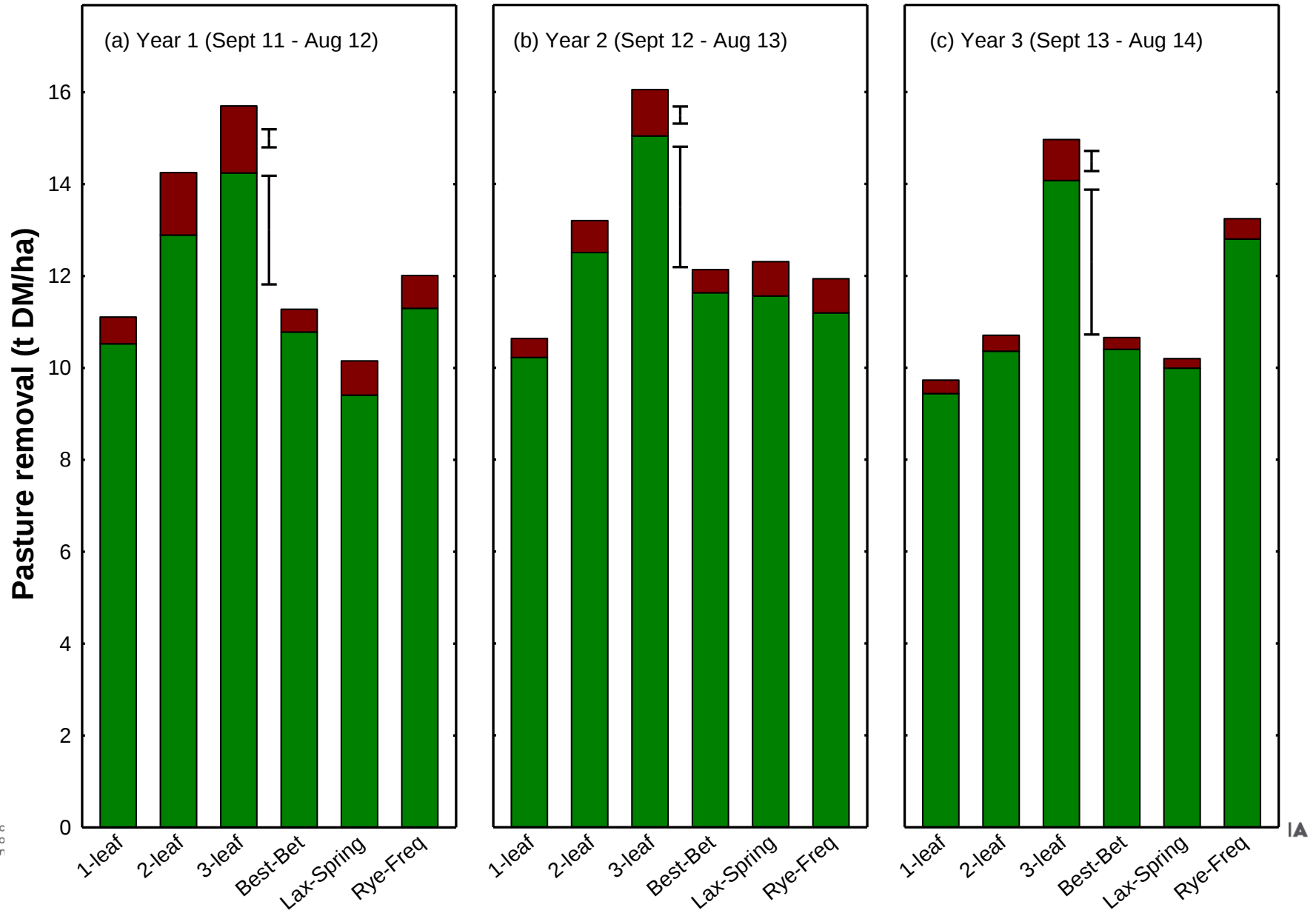
Lucerne – Total Water Productivity



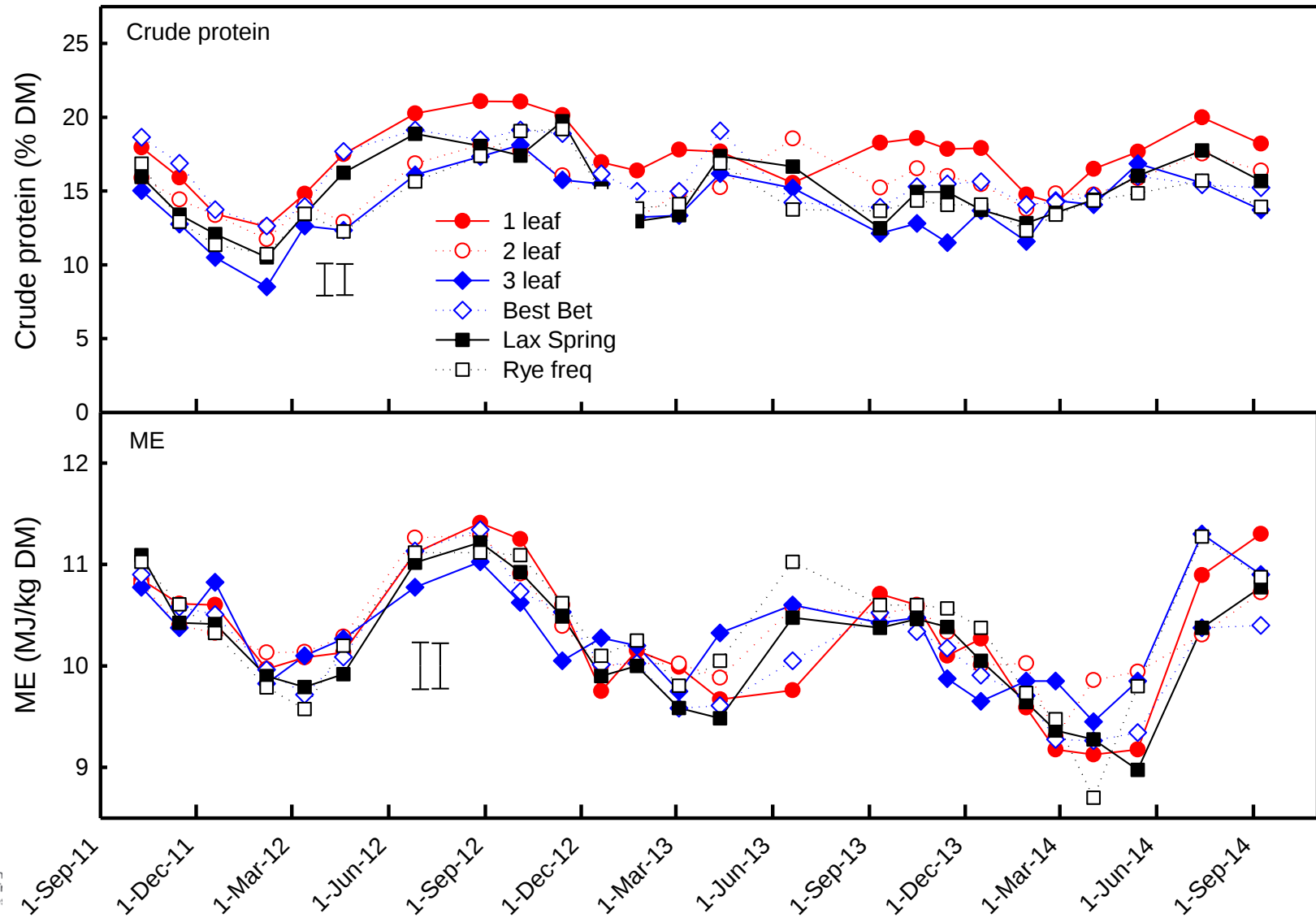
Grazing management of tall fescue



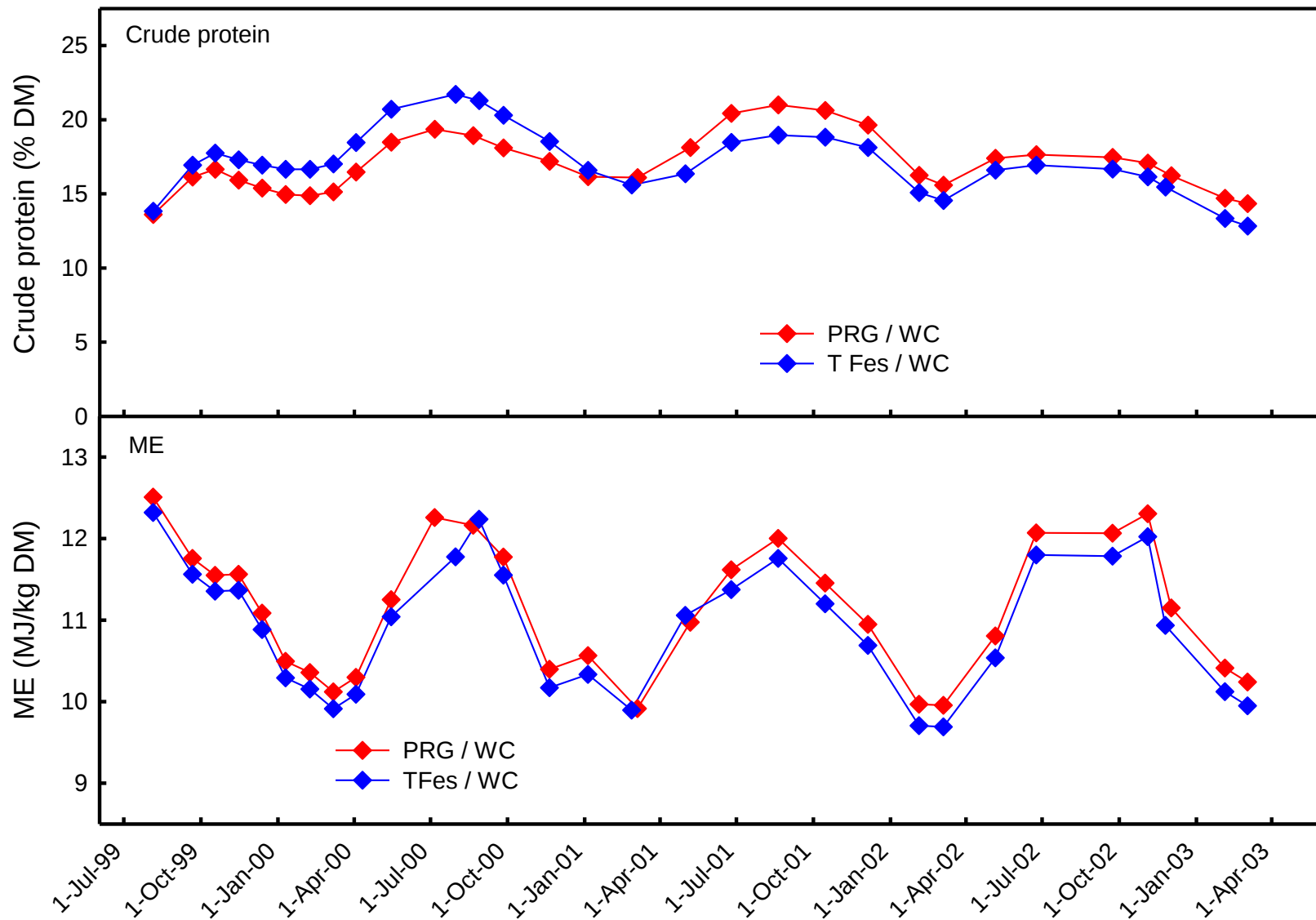
Pasture removal (Grazed – green, topped – red)



Nutritive Value



Nutritive Value – Fescue vs Ryegrass



Technotes

- 8. Variation in Irrigation Requirements of Forages in Northern Victoria.
- 9. Water Productivity of Irrigated Forages in Northern Victoria
- 10. Grazing irrigated lucerne – a guide for dairy farmers
- 11. Research Technote – irrigating lucerne '*Irrigating lucerne when water is limited*'
- 12. Research Technote – Grazing tall fescue '*Grazing management of tall fescue*'

Current location

<http://agriculture.vic.gov.au/agriculture/dairy/pastures-management/irrigated-pastures>

Current projects

Summer Survival of Perennial Ryegrass (2014-17) – DEDJTR, DA

Perennial Ryegrass Genetic Gain (2014-17) – DEDJTR, DA

Perennial Ryegrass – Endophyte Interactions (2015-18) – DEDJTR, DA

Forage Value Index – Trial Sites (2015-18) – DEDJTR, DA

Perennial Ryegrass Genetic Gain

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Perennial Ryegrass Genetic Gain

Compare performance of cultivars in different environments under grazing

Hypotheses

- breeding has delivered important gains
- gain have come via:
 - (i) improvements within functional types
 - (ii) broadening the range of functional types
- novel endophyte technologies have delivered no direct gains compared with standard endophyte

Perennial Ryegrass Genetic Gain (sown May 2014)

Decade of first use	Diploid		Tetraploid	Australian	European
	Mid – season	Late – season	Late – season		
1940				Victorian SE	
1970	Nui SE				
1980					
1990	Bronsyn SE Bronsyn AR1 Samson (nil) Samson SE Samson AR1 Samson AR37	Impact AR1	Quartet II Endo5	Fitzroy SE Avalon SE Avalon AR1	
2000	Arrow AR1 Kingston SE	One50 SE One50 AR1 One50 AR37 Alto AR1 Alto AR37	Bealey NEA2 Halo AR37 Banquet II Endo5	Endure AR1	Aberdart AR1
2010	Extreme AR1 Extreme AR37	Trojan NEA2 Prospect AR37 Excess AR37	Base AR37		Abermagic AR1
2010+	Kingsgate SE	HSLp4 AR1	KLp902 Endo5 HSLpt8 NEA2		

Perennial Ryegrass Genetic Gain

Two Victorian Sites

- North Mooroopna
- Terang

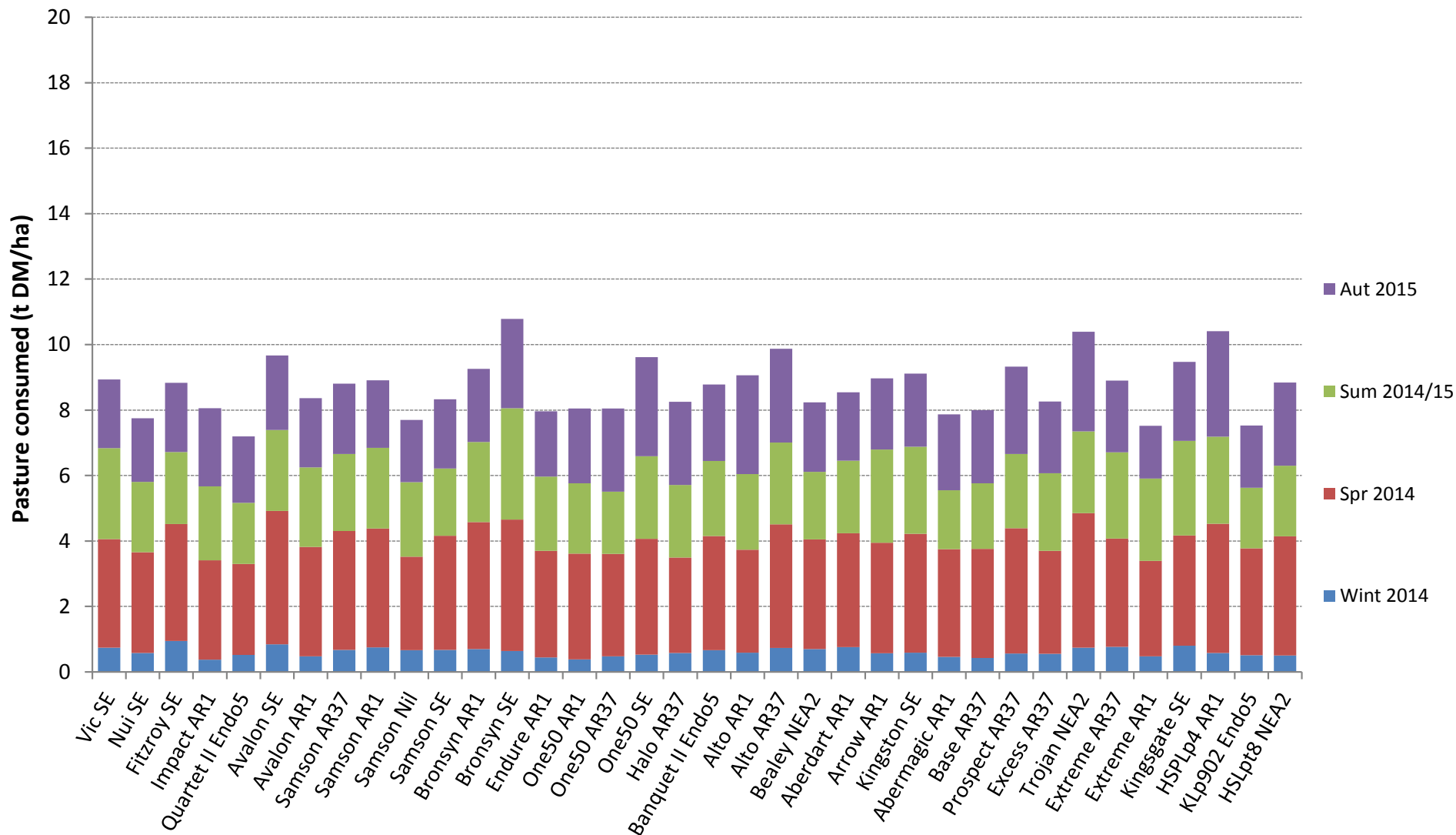
Links to similar studies

- New Zealand (2 sites)
- Ireland (1 site)

(some cultivars in common across all sites)

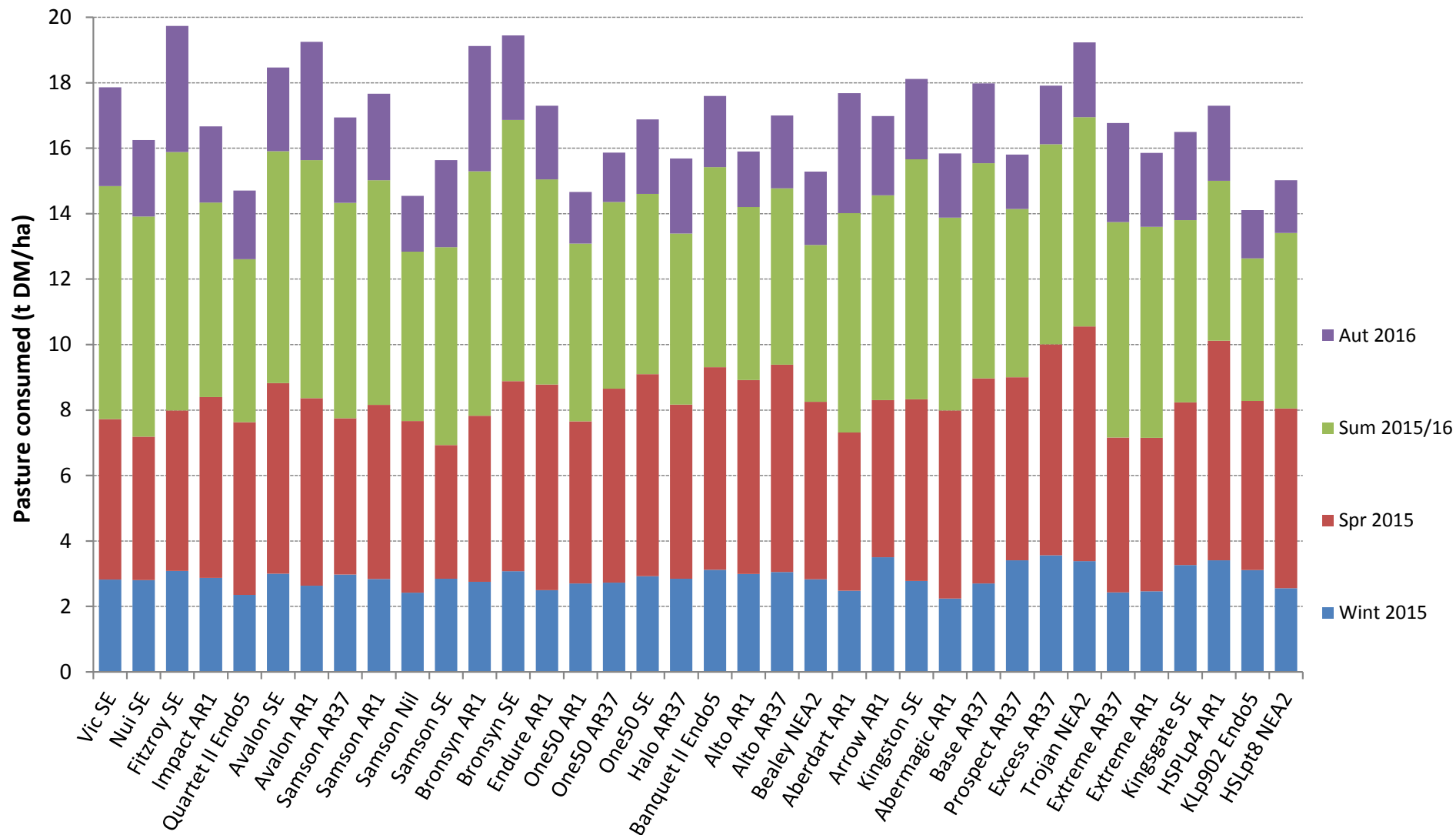
DM removal – Year 1

Mooroopna



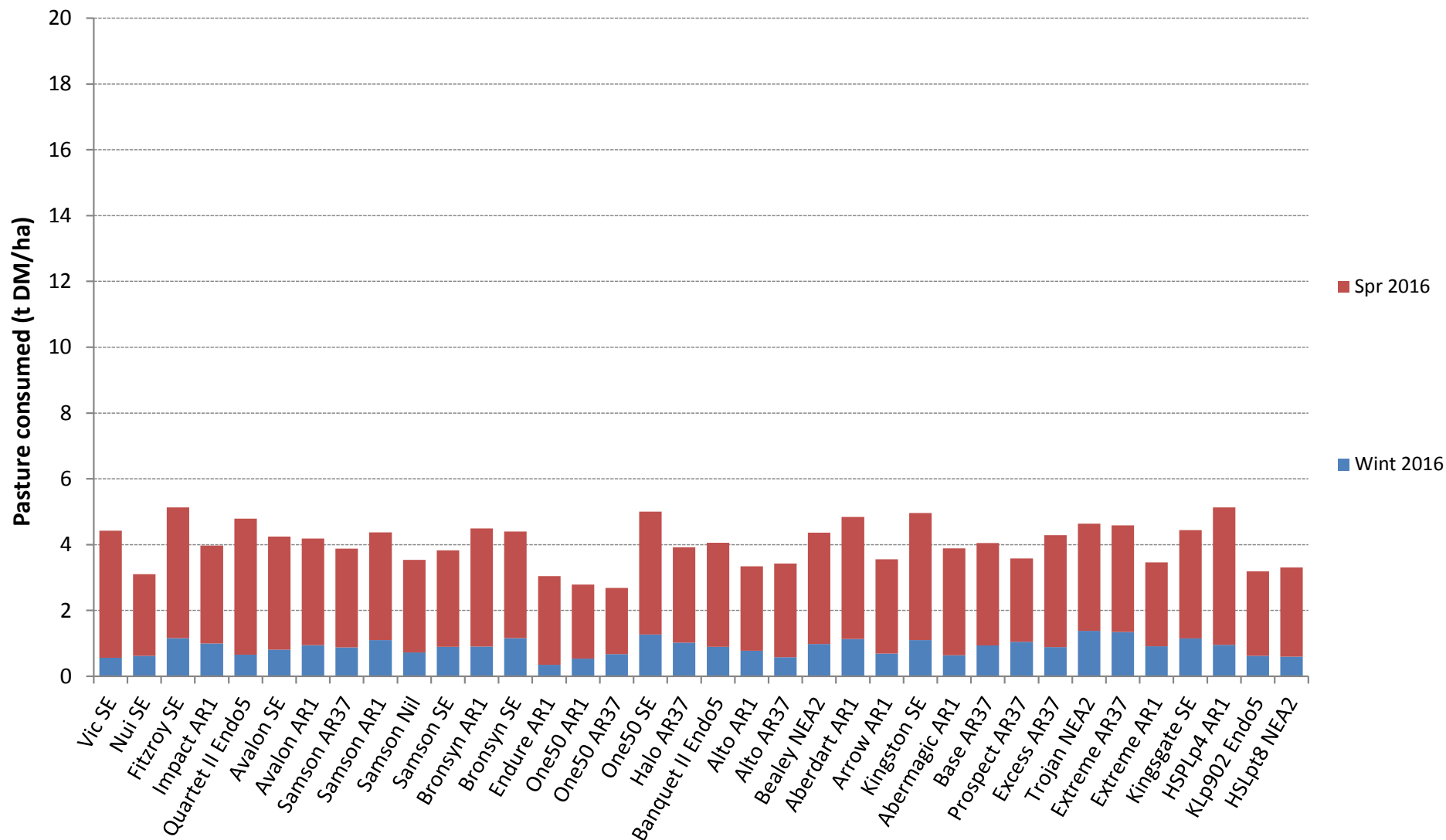
DM removal – Year 2

Mooroopna

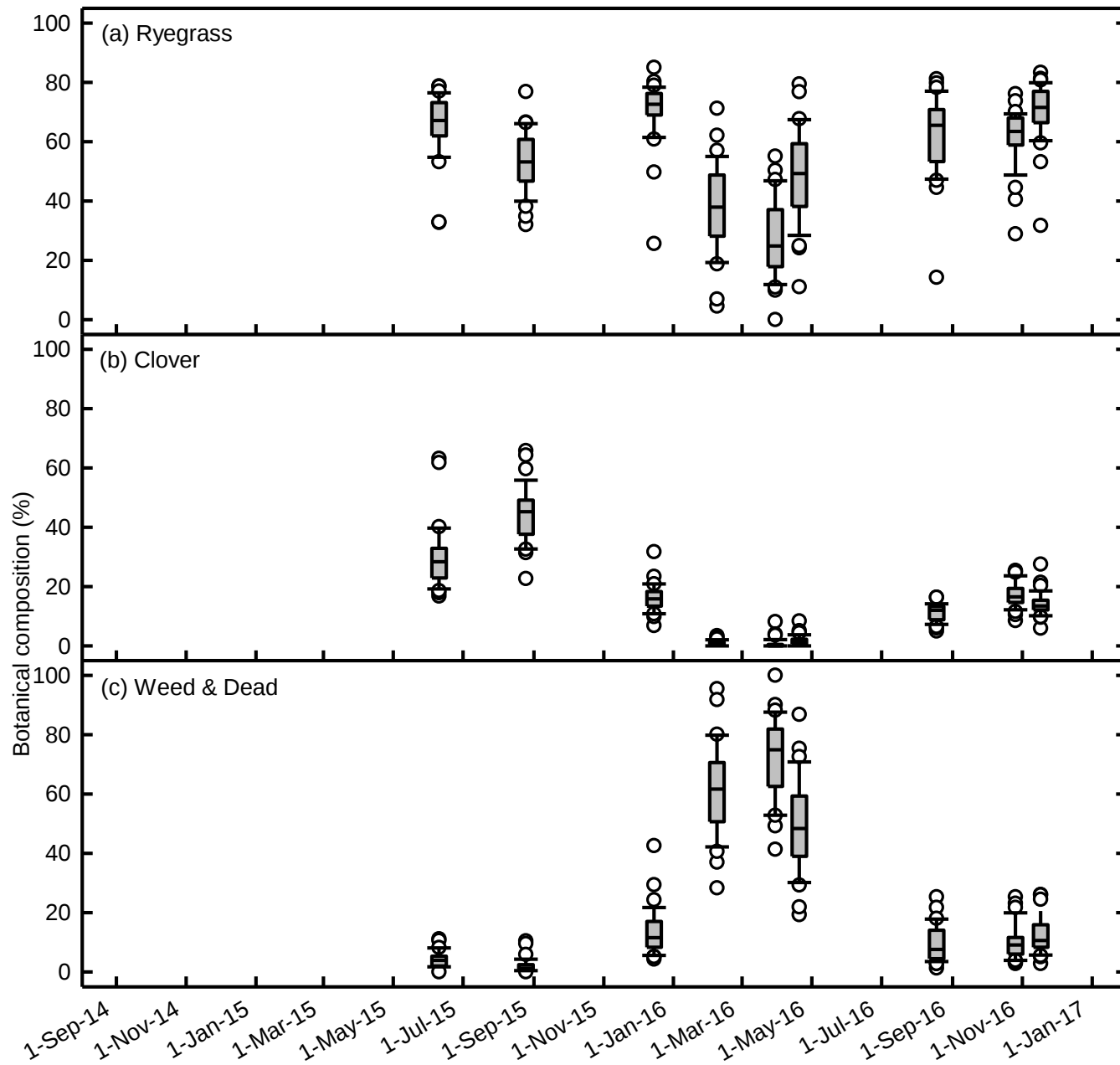


DM removal – Year 3

Mooroopna (until mid Nov)



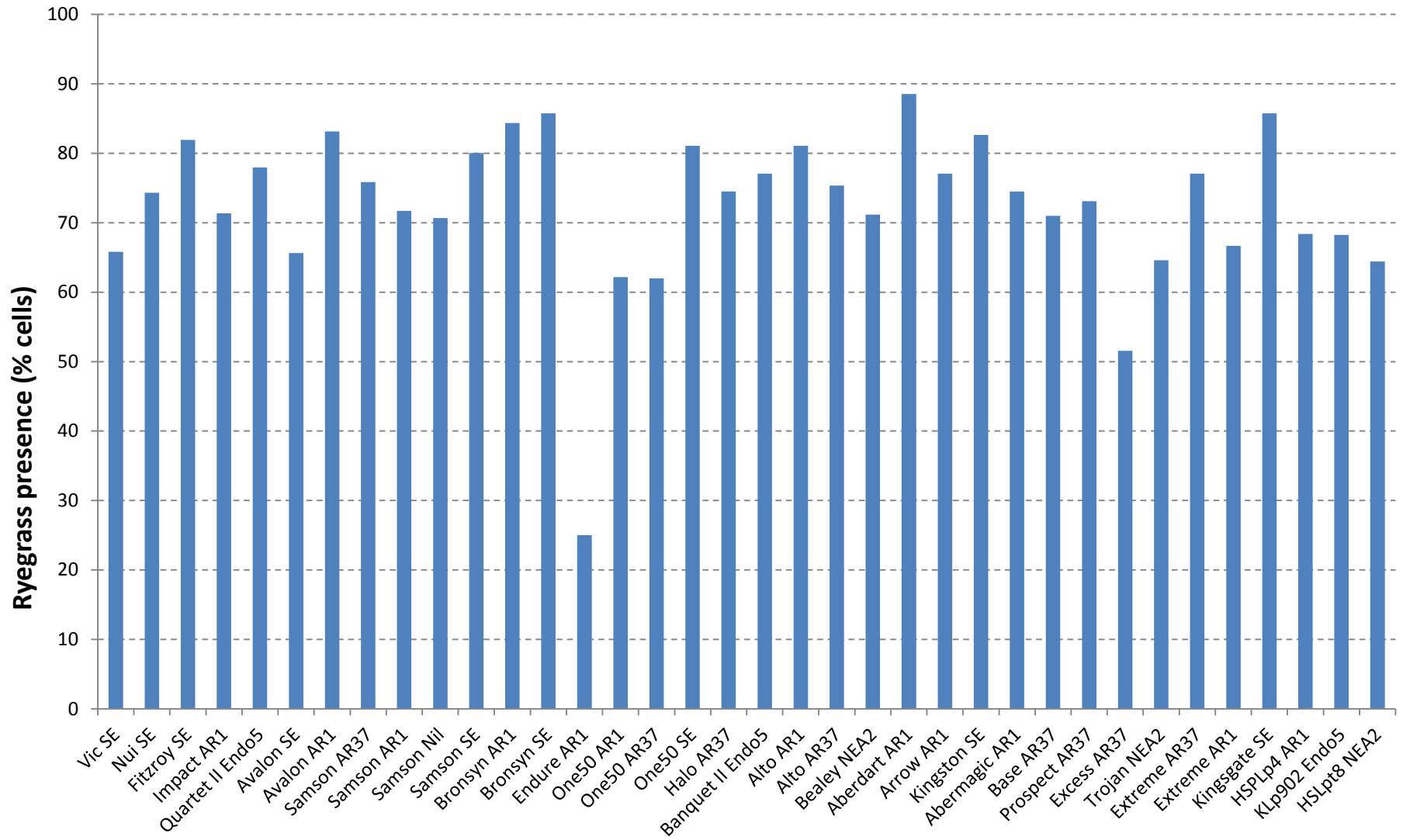
Botanical Composition



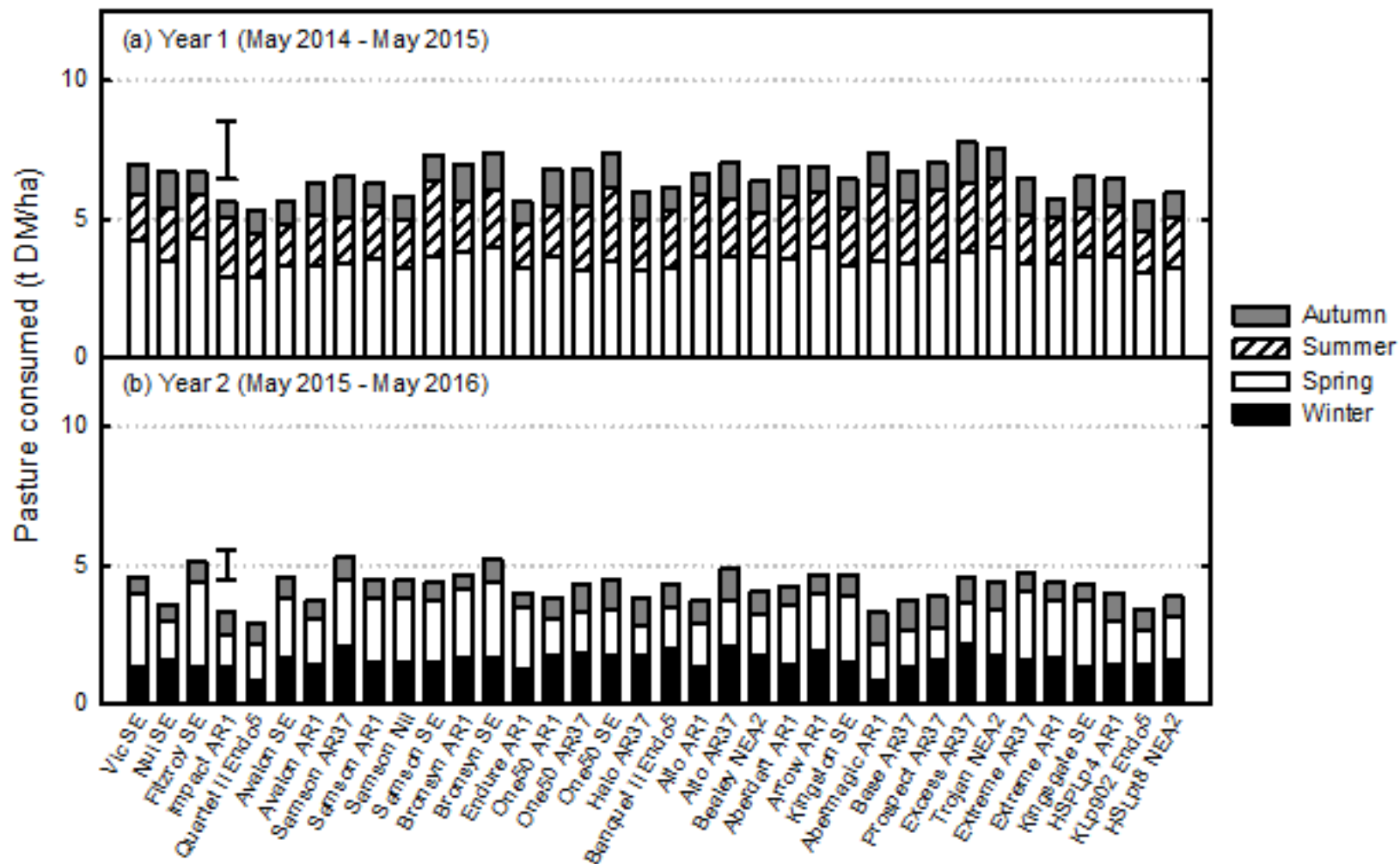


Ryegrass Frequency

Mooroopna (early May)



Dry matter removal – Terang (south-west Victoria)



Summer Survival Perennial Ryegrass

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Summer survival of perennial ryegrass

Evaluate options for 'over summer' management for persistence and production

Hypotheses

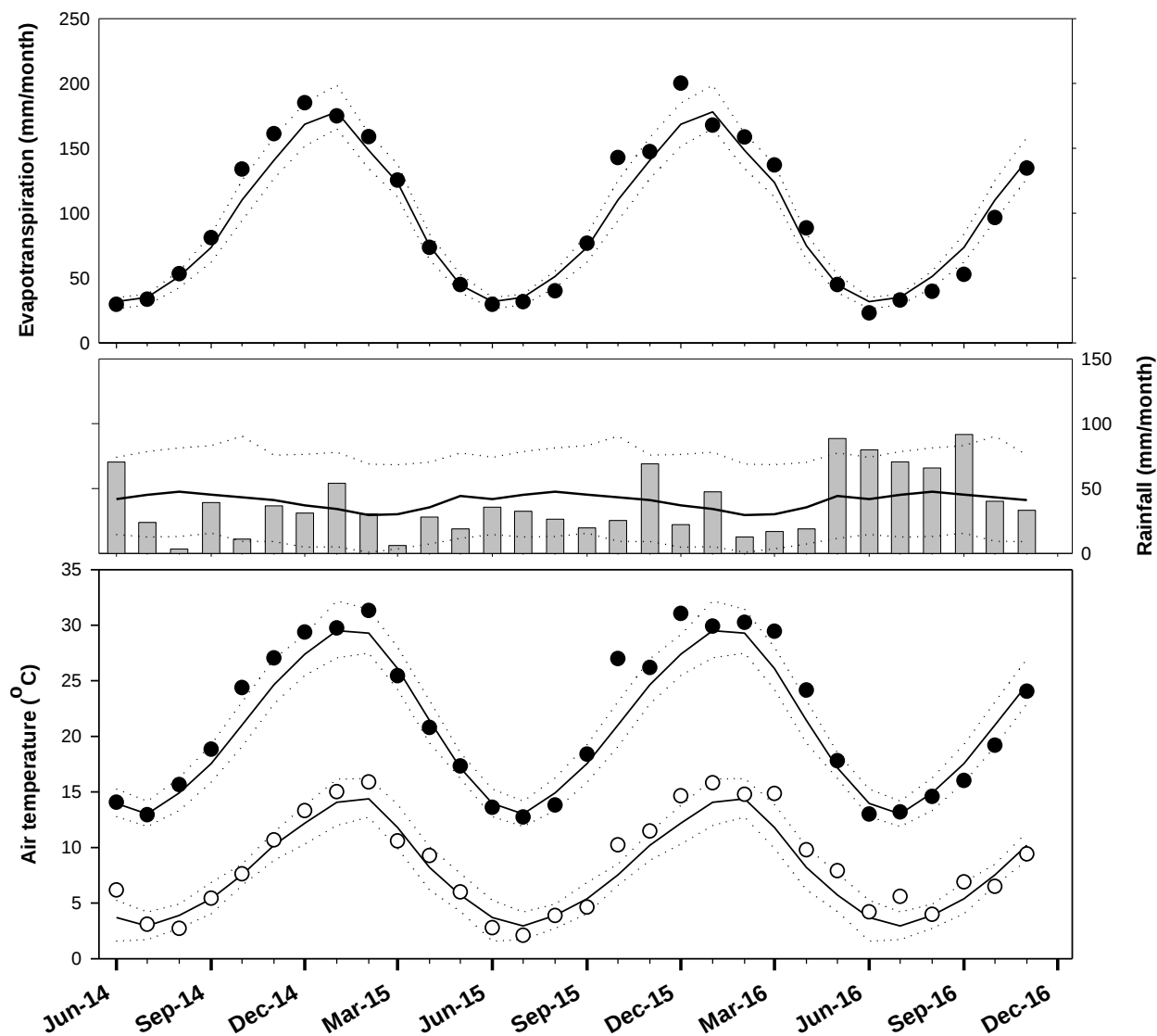
- cultivars with NW Spain genetics are more able to withstand summer drought
- limited summer irrigation will enhance survival
- restricted grazing will aid survival of ryegrass when not irrigated over summer

Summer survival of perennial ryegrass

Three sites

1. Tatura – DEDJTR – screening study
2. Katunga – on-farm – grazed site
3. Rochester – on-farm – grazed site

Tatura – Weather conditions



Screening Study - Tatura

Sown May 2014

Genotypes (15)

Perennial ryegrass cultivars (10)

- Avalon, Bronsyn, Extreme, Impact, Impact 2 (Trojan), One50, Prospect, Banquet 2, Base, Bealey

Ryegrass variations (3)

- Barberia, Shogun, Matrix

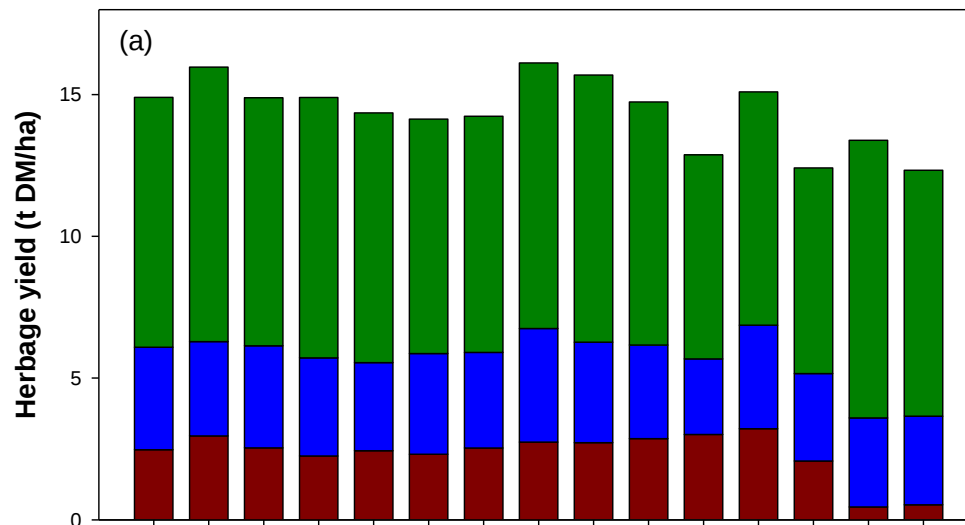
Tall fescue cultivars (2)

- Advance Max P, Quantum 2 Max P

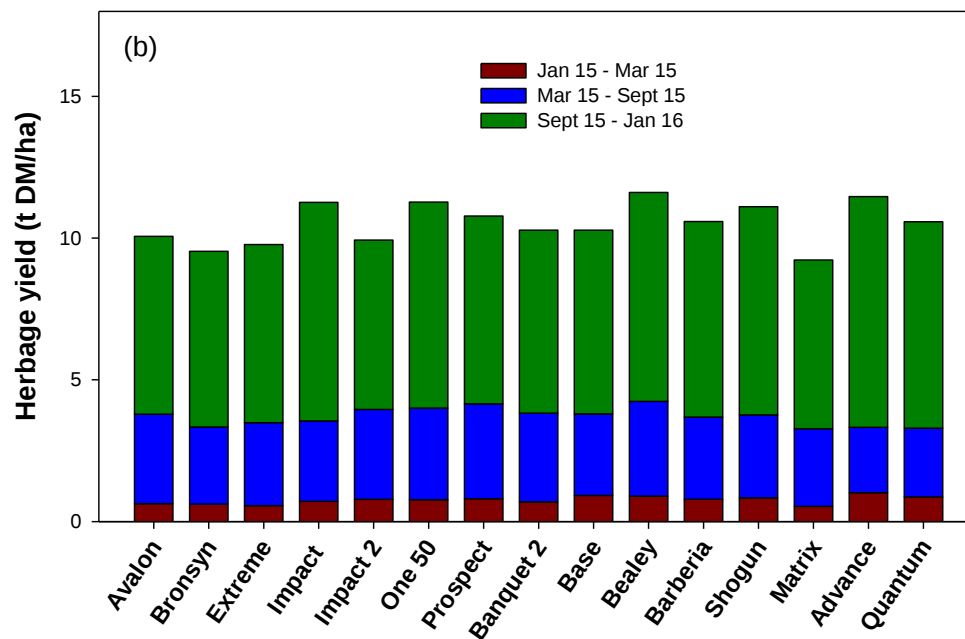
Irrigation strategies (2)

- full irrigation,
- no irrigation post heading (Jan-Mar),

Summer survival of perennial ryegrass (Jan 15 – Jan 16)

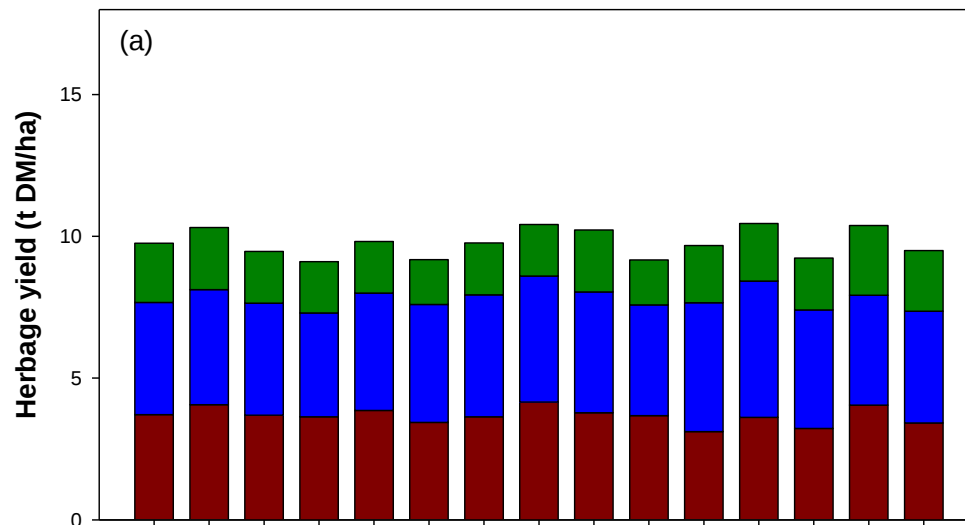


Fully-irrigated bay

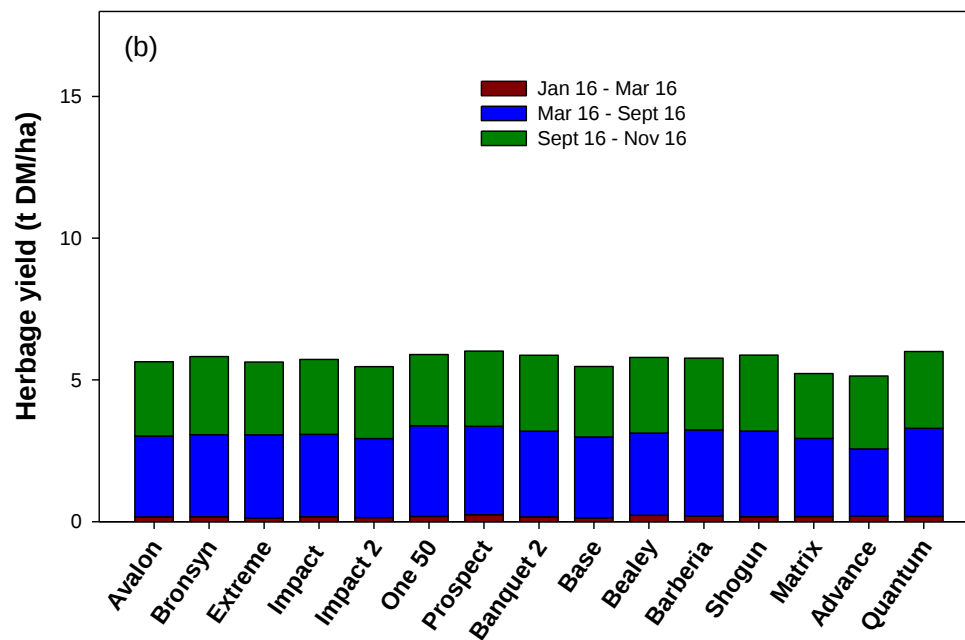


**Not irrigated
Jan – mid Mar 15**

Summer survival of perennial ryegrass (Jan 16 – Nov 16)



Fully-irrigated bay

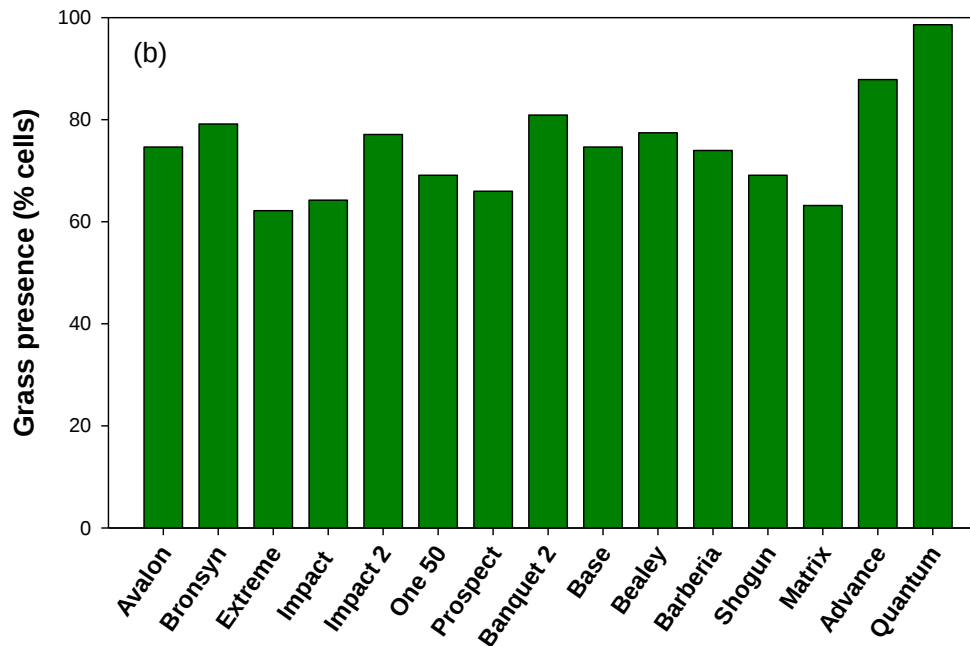
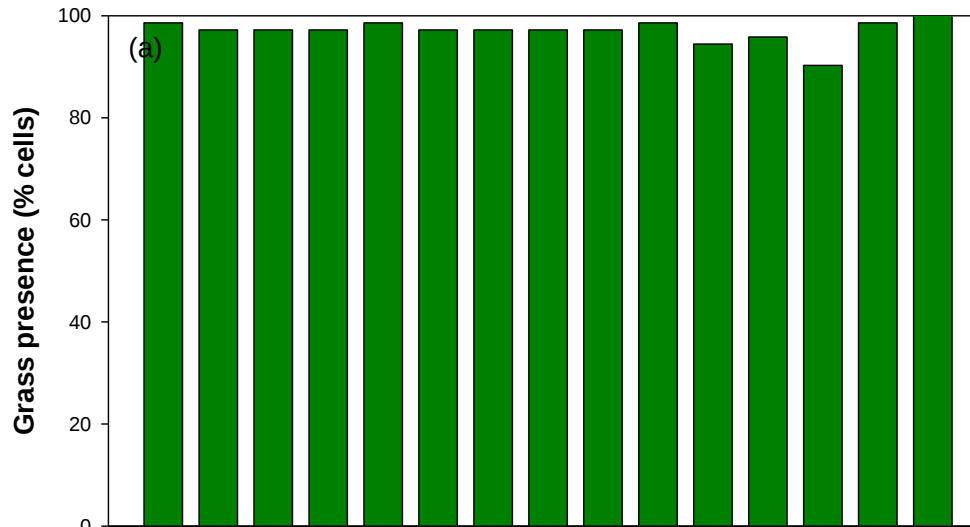


**Not irrigated
Late Dec 15 – mid
Mar 16**

Summer survival of perennial ryegrass

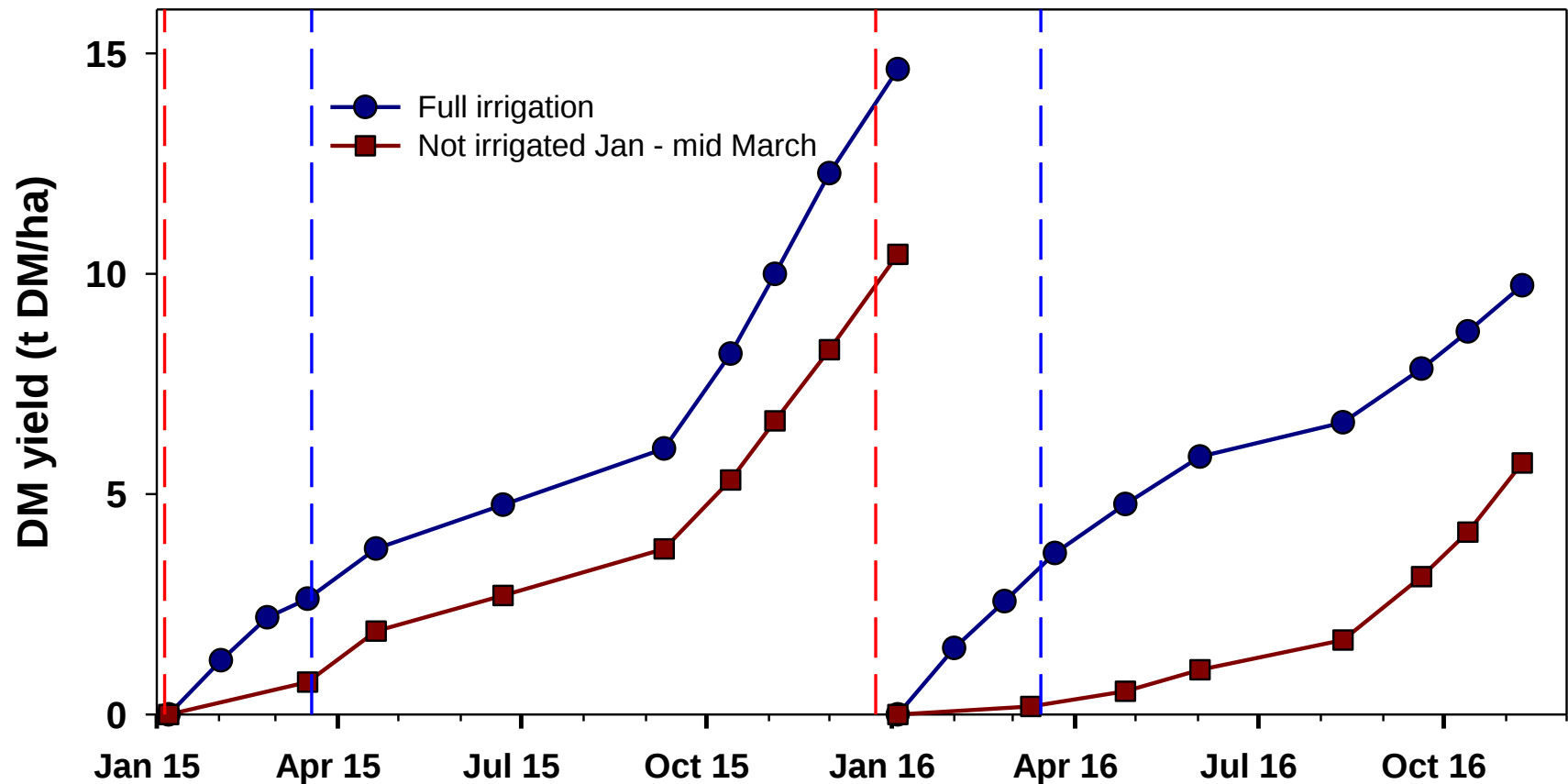
30/3/2016

Fully-irrigated bay



Not irrigated
Jan – mid March

Cumulative Yield - Screening study (ryegrass only)





Summer survival of perennial ryegrass

On- farm grazed studies (Two sites)

Katunga (Moirra loam) – sown 19 March 2015

Rochester (Wana clay loam) – sown 31 March 2015

☐ **Two bays (each site)**

- Not irrigated from end December to mid March
- Irrigated 1-3 times based on ETo-R

☐ **Within each bay (strip plot design)**

- 5 perennial cvs (with and without oversowing),
1 short-lived cv and 1 annual cv (sown each year)
- 2 summer grazing strategies

Grazed studies – ryegrass cultivars

Ryegrass cultivars

Avalon

Impact 2 (Trojan)

One50

Base

Bealey

Barberia

Crusader

Endophyte

SE

NEA2

SE

AR37

NEA2

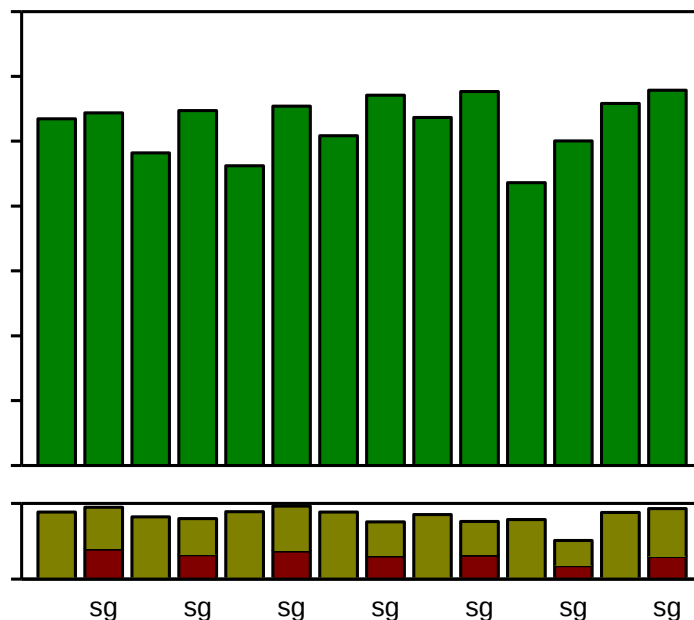
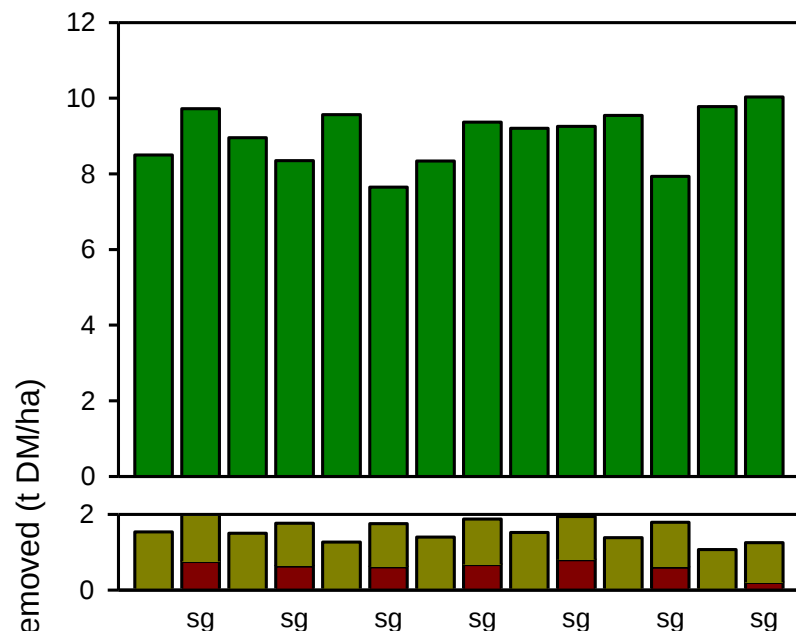
Rochester site

No summer irrigation

(23 Dec 15 – 24 Mar 16)

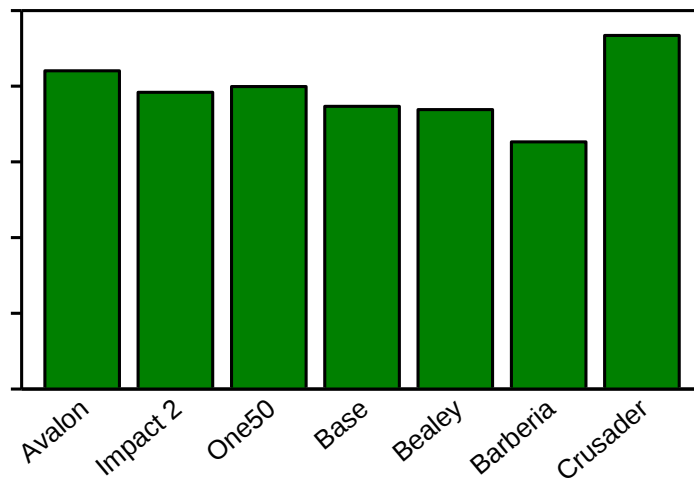
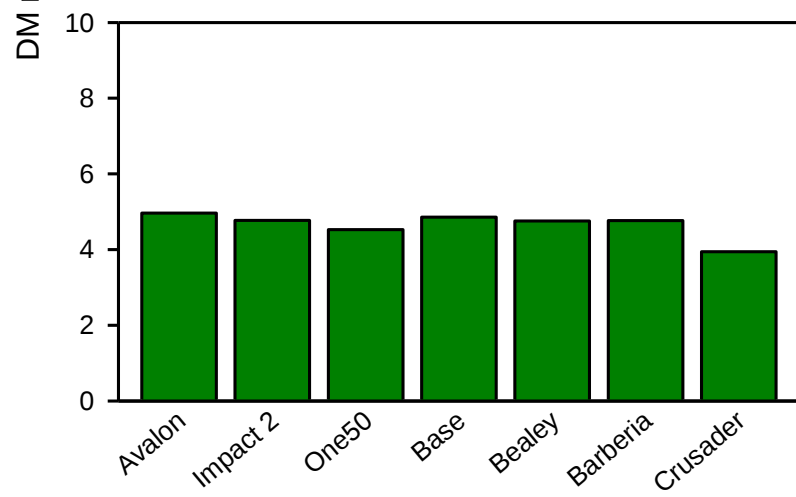
One summer irrigation

(23 Dec 15 – 24 Mar 16) (5 Feb 16)



2016

Summer
grazing



2015

Sown

31 Mar 2015

Last grazed

18-21 Dec 2015

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Perennial Ryegrass – Endophyte Interactions

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Perennial ryegrass – endophyte interactions

Objectives

- Screen a range of novel perennial cultivars x endophyte combinations in contrasting environments (production, persistence and alkaloid profiles)
- Assess performance of selected cultivar x endophyte combinations under grazing (production, persistence, grazing behaviour and alkaloid profiles)
- Provide information to key stakeholders, service provider groups and farmers

Perennial Ryegrass – Endophyte Interactions

Tatura (2 bays)

- Full irrigation
- Limited summer irrigation

Field study

Trojan (nil, NEA2, NEA3, NEA10, NEA11)

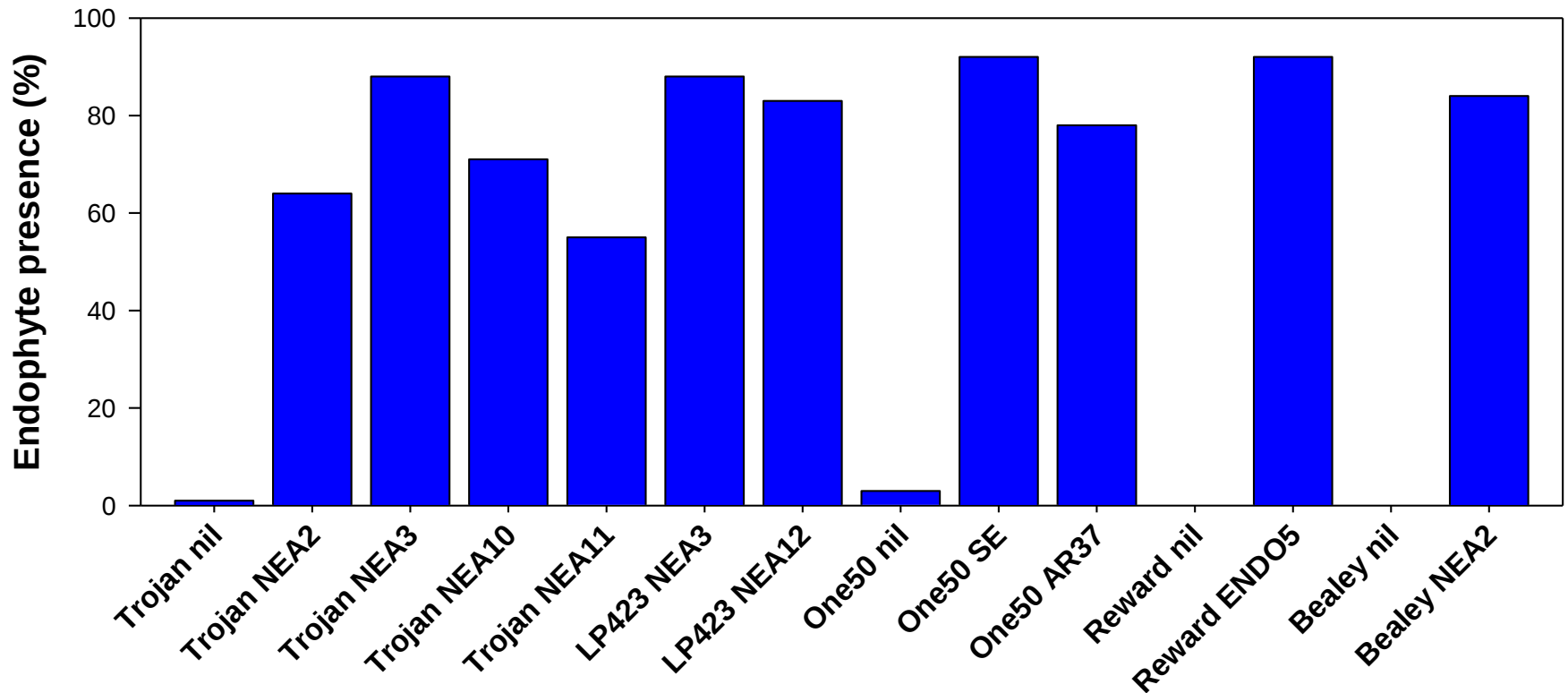
LP423 (NEA3, NEA12)

One50 (nil, SE, AR37)

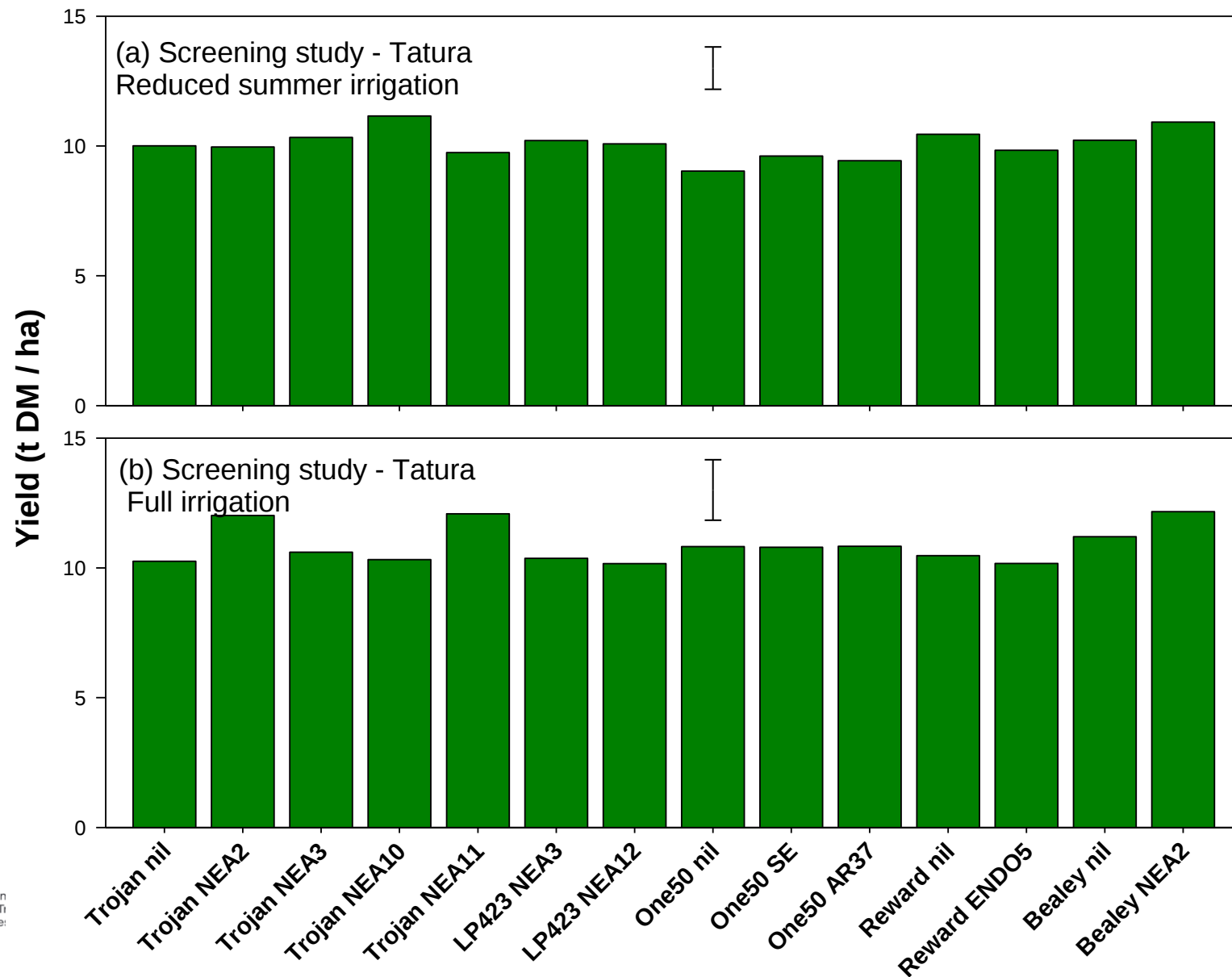
Reward (nil, ENDO5)

Bealey (nil, NEA2)

Endophyte activity (presence)



PRG – Endophyte Interactions (Yield t DM/ha Jan-Nov 2016)



Forage Value Index Field Site

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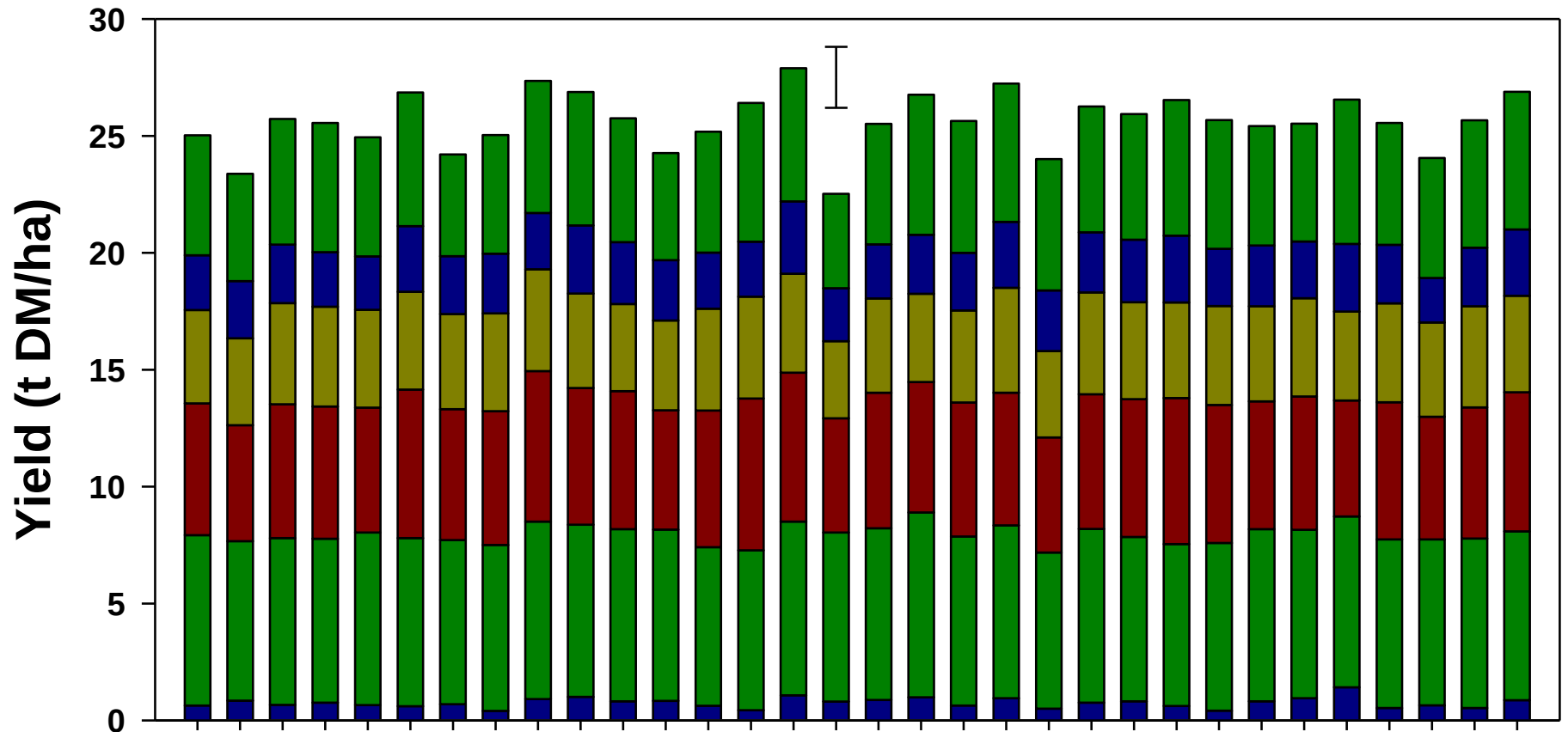
Forage Value Index – Trial Sites

Compare performance of cultivars and contribute to development of a ‘Forage Value Index’

Sites

- northern Victoria (Tongala – Lemnos loam)
- south western Victoria (Timboon)
- Gippsland (Ellinbank)
- Tasmania (Elliot)

FVI – Tongala site





Oct 2015



Nov 2015



Jan 2016

Acknowledgements

Current Colleagues – Alister Lawson, Mary-Jane Rogers
Technical staff of the Dairy Production Science Group (Tatura)

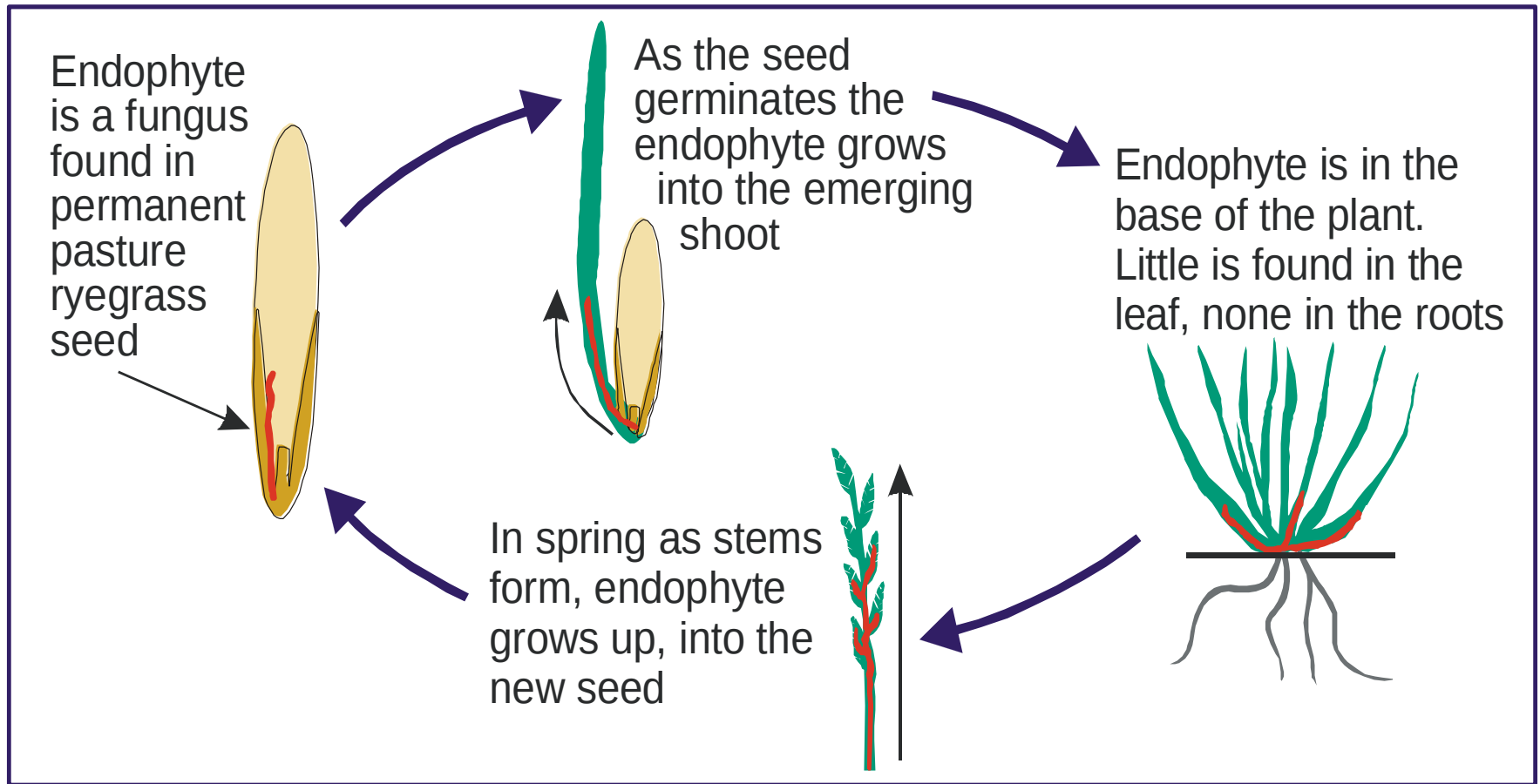
Former Colleagues - Kerry Greenwood, Geoff Mundy

Funders – DEDJTR (Agriculture), Dairy Australia, Murray-Dairy, Gardiner Foundation

Farmer and industry involvement with 'Reference / Steering Groups' across the project collective.

Questions ?

Perennial Ryegrass - Endophytes



Perennial Ryegrass Endophytes

Chemical	Effects on		Endophyte				
	Insect pests	Livestock	Standard	AR37	Endo 5	NEA2	AR1
Peramine	✓✓	None	Yes		Yes	Yes	Yes
Ergovaline	✓	Heat stress Production loss	Yes		Low	Low	
Lolitrem	✓	Ryegrass staggers	Yes			V. Low	
Epoxy - janthitrem	✓✓✓	Ryegrass staggers		Yes			
			Production loss Ryegrass staggers	Minimal ryegrass staggers	Animal safe Production gains		

Endophyte – Insect control (NZ)

Diploid ryegrasses

Insect	AR1	AR37	Standard endophyte	Without endophyte
Argentine stem weevil	◆◆◆◆	◆◆◆◆ ¹	◆◆◆◆	-
Pasture mealybug	◆◆◆◆	◆◆◆◆	◆◆◆◆	-
Black beetle	◆	◆◆◆	◆◆◆	-
Root aphid	.. ²	◆◆◆◆	◆◆	-
Porina	-	(◆◆◆) ³	◆ ³	-

Tetraploid ryegrasses⁴

Insect	AR1	NEA2	AR37	Endo5	Without endophyte
Argentine stem weevil	◆◆◆	◆◆ ¹	◆◆◆ ¹	◆◆◆ ¹	-
Pasture mealybug	◆◆◆◆	(◆◆◆◆)	◆◆◆◆	◆◆◆◆	-
Black beetle	◆	◆◆◆	◆◆◆	◆◆◆	-
Root aphid	.. ²	(◆)	◆◆◆◆	(◆◆) ⁵	-
Porina	-	Not tested	Not tested	(◆) ³	-

Forage Value Index – Trial Sites

- 28-32 cultivar / endophyte combinations
- Aligned with 'Pasture Trial Network'

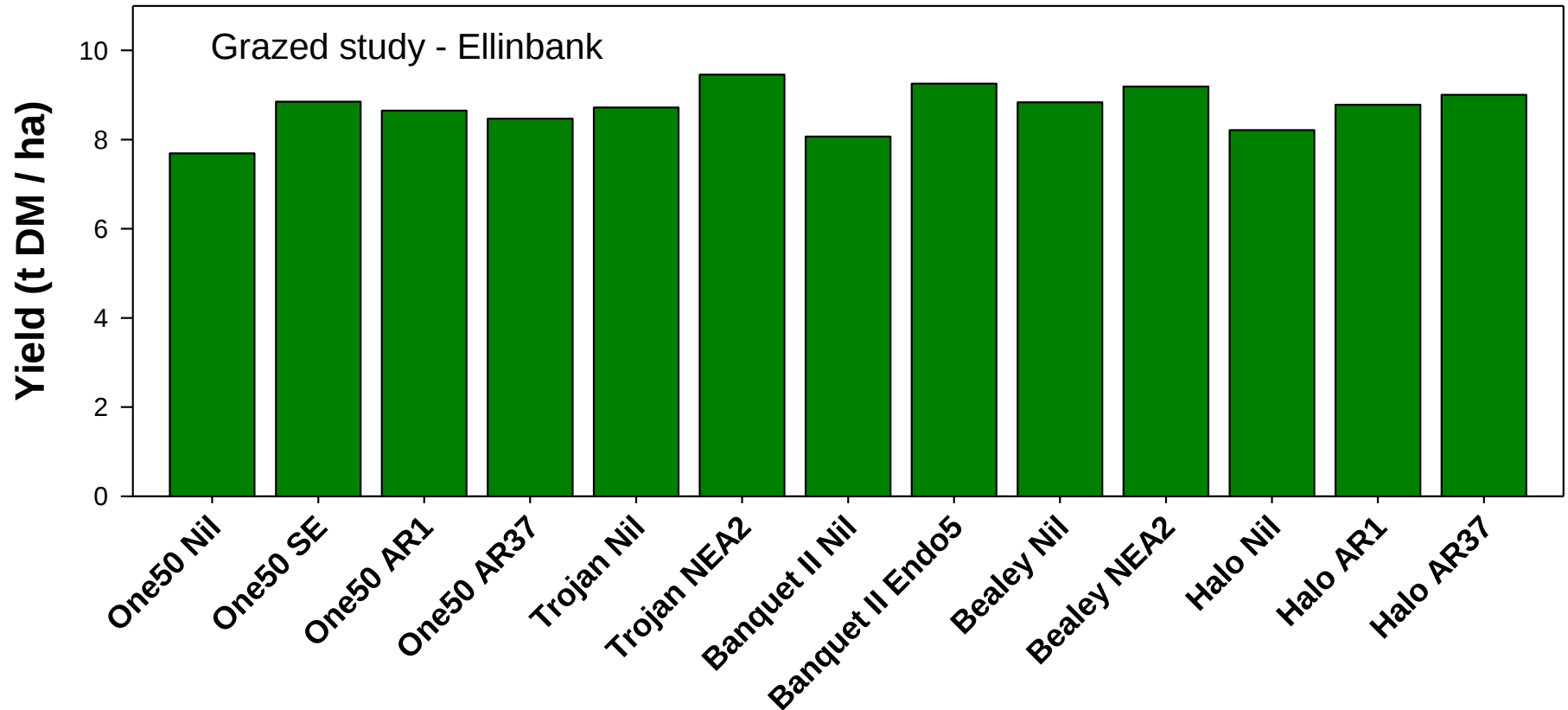
Measurements

- DM yield (mechanical)
- Nutritive characteristics
- Disease incidence
- Heading (estimate at harvest)
- Pasture composition (if required)

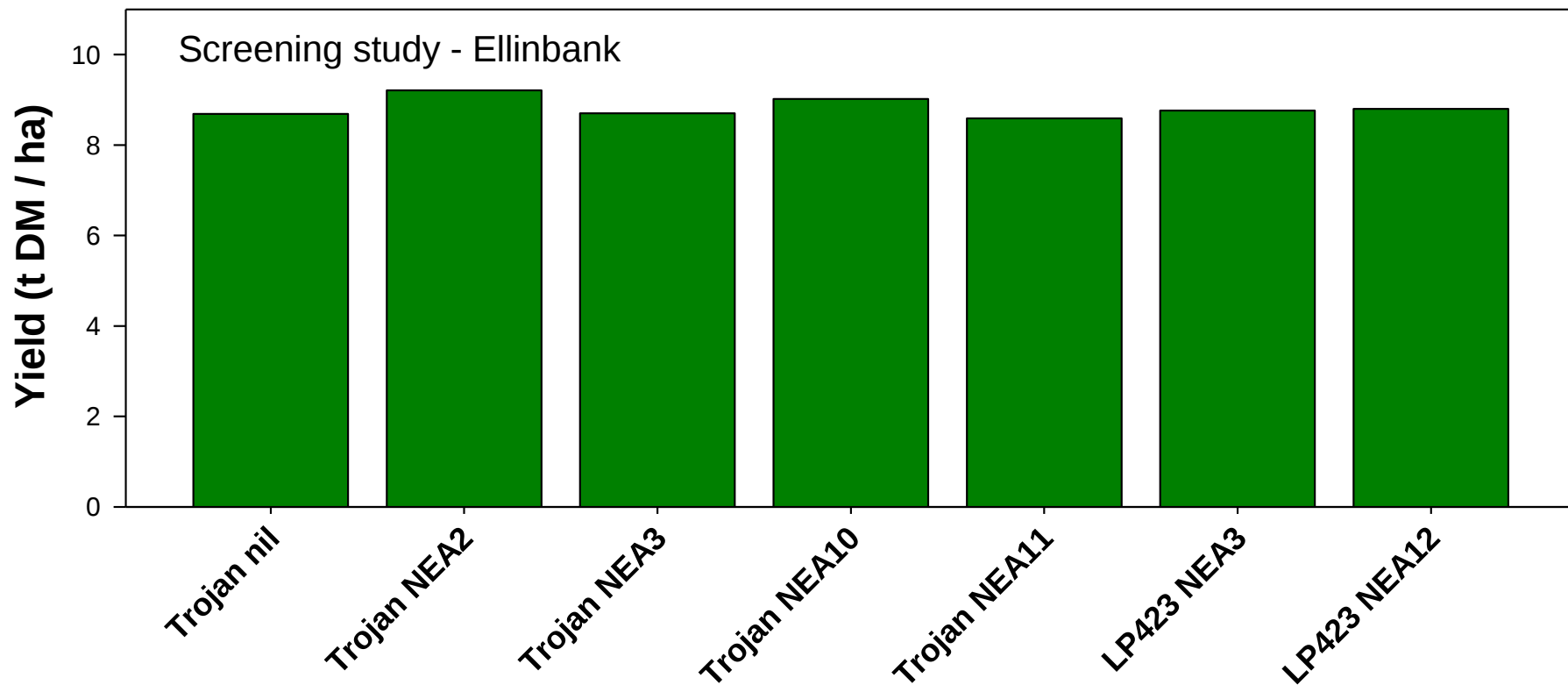
Endophyte – Grazed site (Ellinbank)



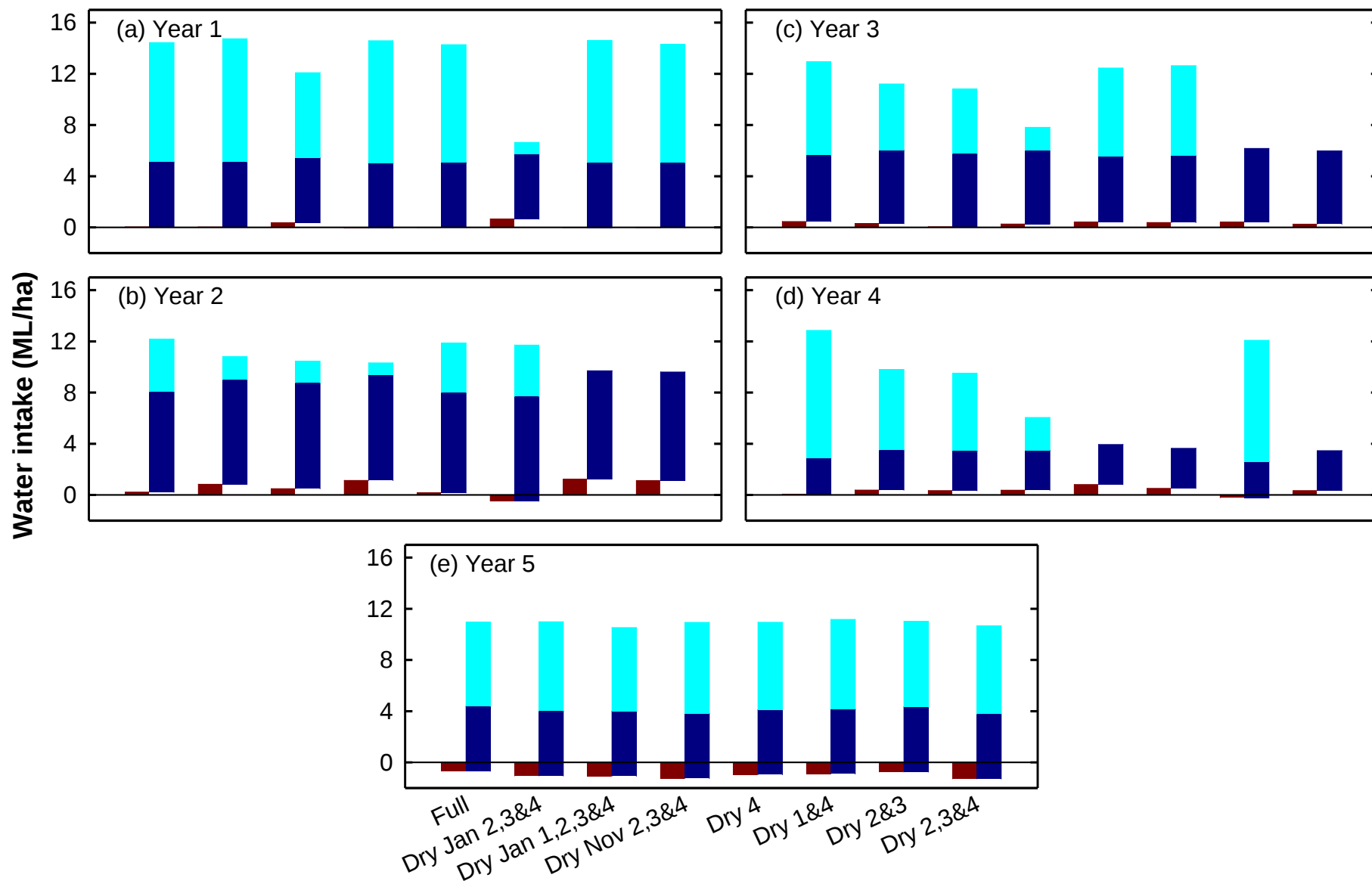
Perennial ryegrass yield (t DM/ha) [May 2015 to June 2016]



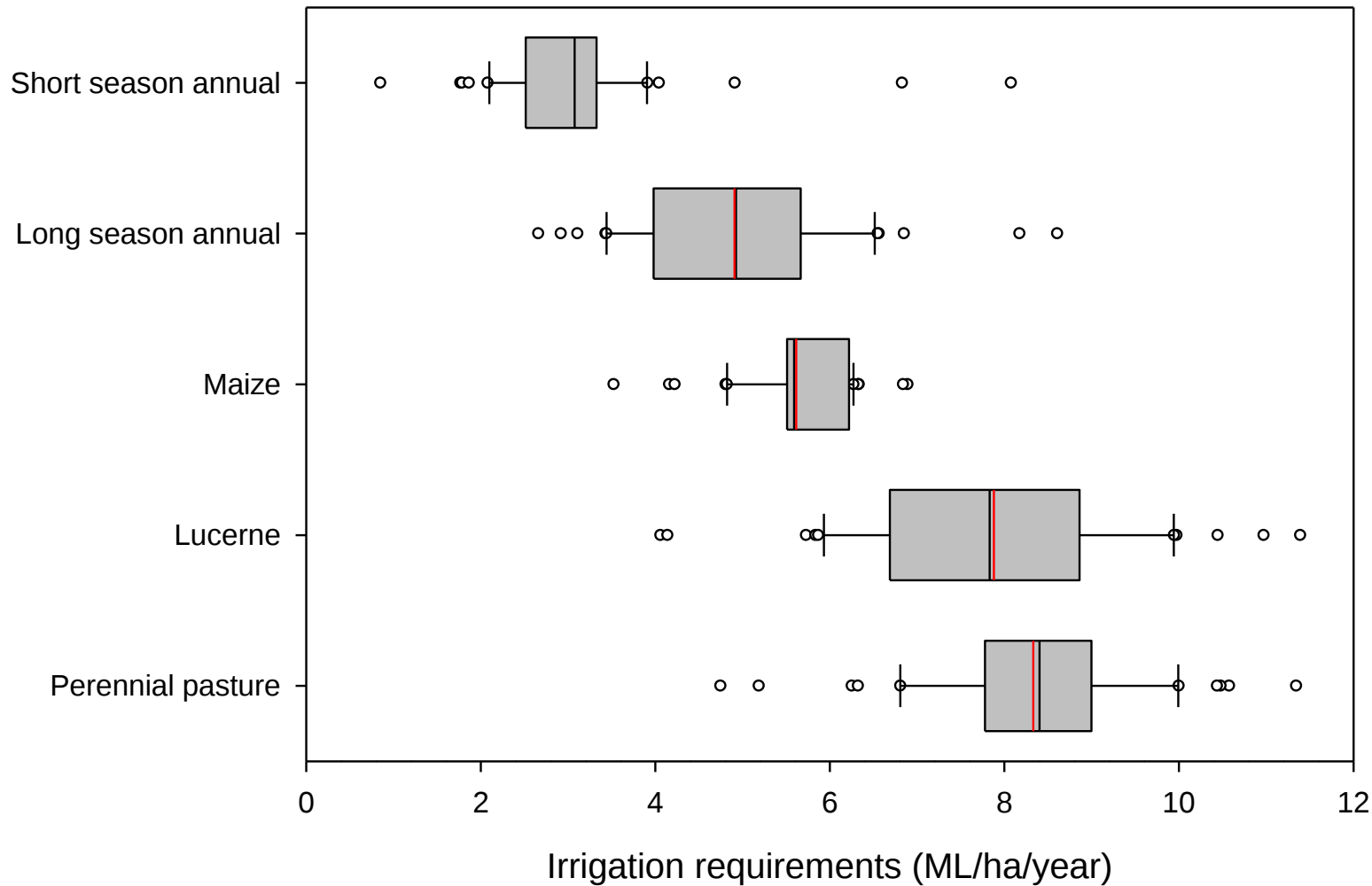
Perennial ryegrass yield (t DM/ha) [May 2015 to May 2016]



Lucerne – water use



Tatura – Irrigation Requirements



Flexible future forage systems for variable water supply

Objectives

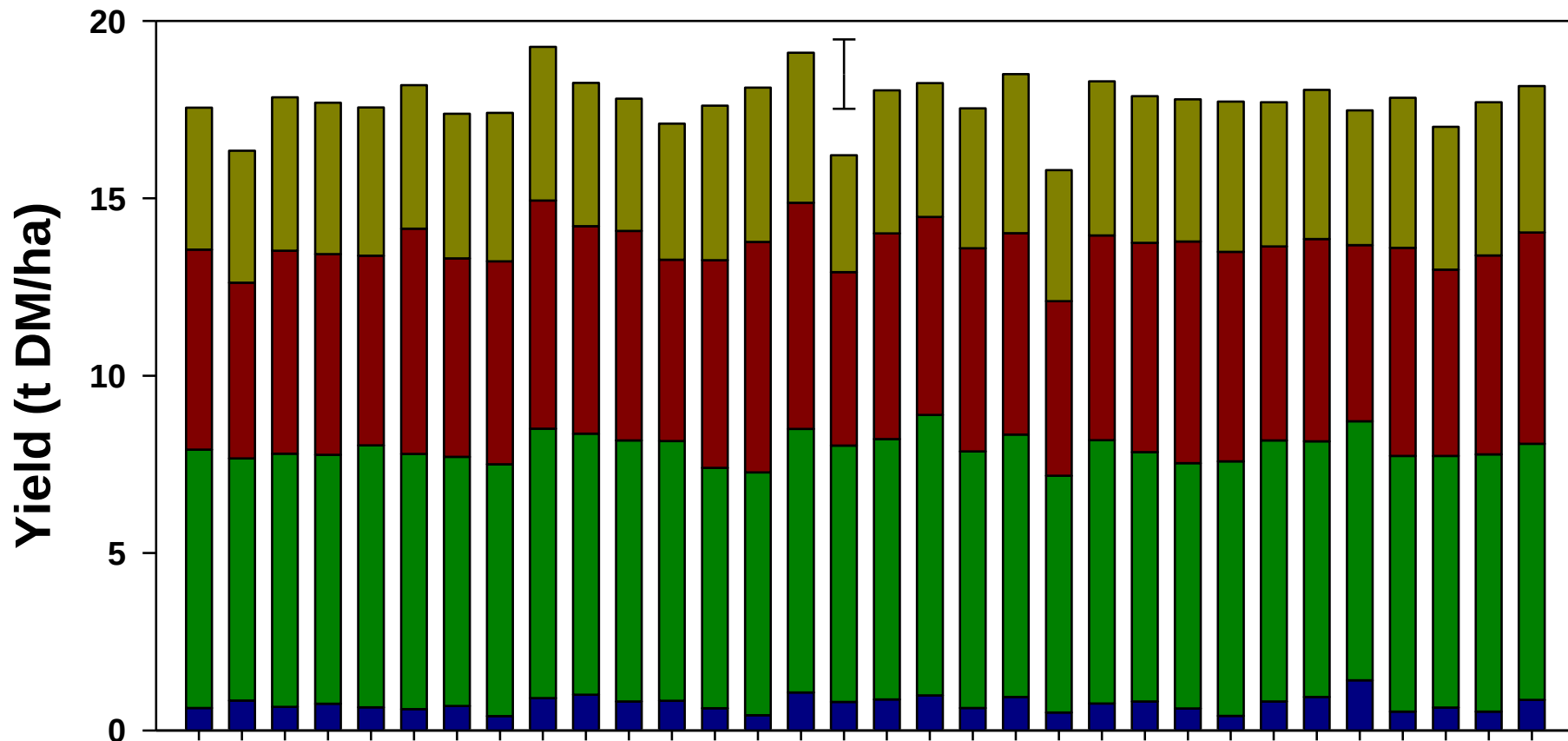
- Determine the performance of lucerne under variable (deficit) irrigation strategies
- Develop practical, physiologically-based grazing criteria for tall fescue
- Contribute to increased adoption of better adapted forages

Background

Tall fescue - an alternative to perennial ryegrass

- 3 experiments with 10 years data
 - 20% greater annual DM removal
 - 40% increase in DM removal during summer / autumn
 - similar DM removal during winter / spring
 - similar DMD and CP

FVI – Tongala site [year 1]



FVI – Tongala site [year 2]

