



Nutritional constraints to high production from dairy cows in southern Australia

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Topics Covered

- Diversity of feeding systems
- Nutritional principles
- Grazing versus mixed ration systems
- Challenges in feeding to genetic potential
- Monitoring feeding system performance
- Issues for Australian dairy farmers

Australian Dairy Regions



Export oriented

Diverse farming systems

Pasture-based

Feed 40-65% of total costs

Declining terms of trade

Variable prices

Diversity of Feeding Systems



**100% grazed pasture
& conserved fodder**

**Grazed pasture +
purchased feeds**

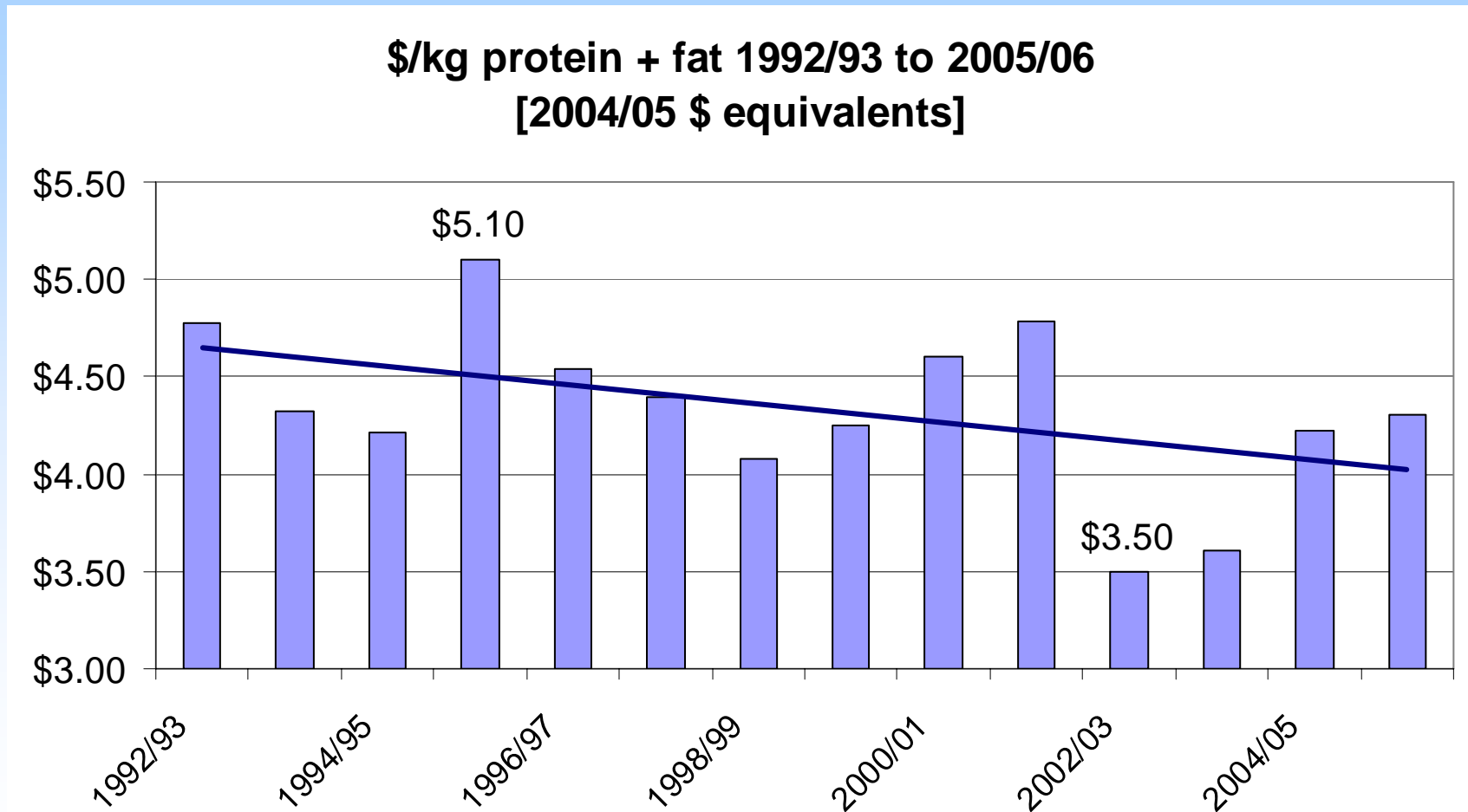


Feed lots

Why are Systems Diverse?

- **Different business & personal goals**
- **Different skills & knowledge**
- **Different equity & attitude to risk**
- **Variable resource base**
 - **Land (area/capability), water, infrastructure, herd**
- **Access to quality labour**
- **Milk price & input costs**

Milk Price Variation



Based on UDV standard base farm (Ian Gibb pers. com.)

Nutritional Constraints to Milk Production

1. Primary:

Intake of metabolisable energy (ME) & protein

2. Secondary:

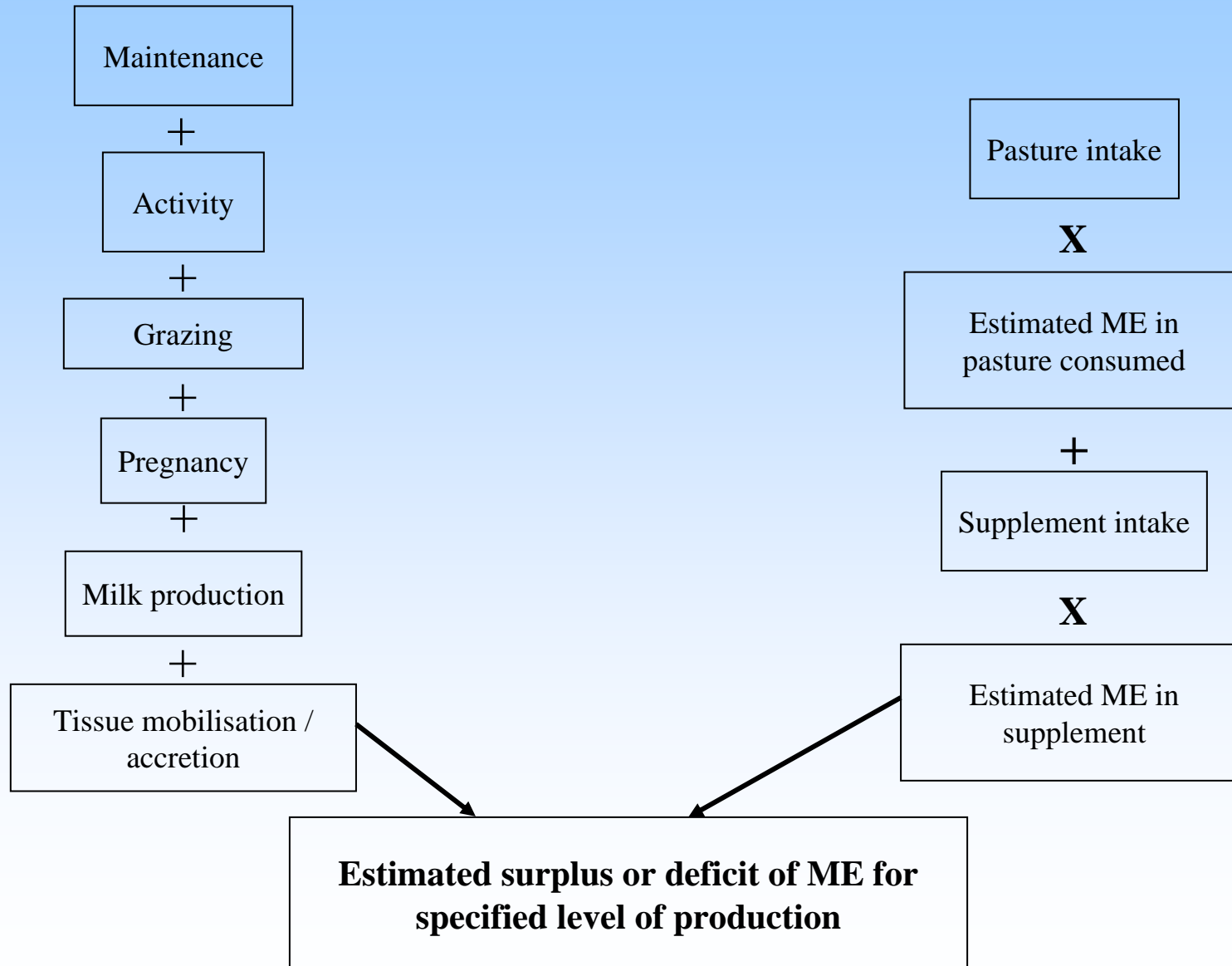
Inefficiencies in nutrient use

- Substitution of concentrates for pasture
- Sub-optimal rumen function
- Insufficient fibre
- Excess crude protein

3. Tertiary:

Essential minerals and vitamins

ME Requirements & Supply



Principals / Facts

- Robust energy systems - ***accurately*** reflect capacity of diets to provide cow's requirements
- Available energy in a feed ***cannot*** be measured by laboratories; we rely on ***estimates***
- Any feed type ***varies*** in chemical composition & ***available energy***
- Issues in ***application*** of existing energy systems
 - Climatic conditions, tropical vs temperate breeds, animal health,
 - Feed intake & ME values, interactions between feeds

Estimated ME Value of Supplements

	ME (MJ/kg)	CP (%)	NDF (%)
Pasture hay	8.4	11	63
	5.3 – 11.2	2 - 30	37 - 82
Wheat	13.1	13	12
	10.5 – 14.1	7 - 23	9 - 24

Feeds in Pakistan will vary in nutritive characteristics

How do we deal with this at farm level?

Intake & Energy Values for a TMR

(MJ/kg DM)	Intake (x maintenance)		
	1.0	3.0	5.0
DE	14.1	13.0	11.8
Methane energy	1.9	1.4	0.9
Urine energy	1.0	0.7	0.3
ME	11.2	10.9	10.6

Source: Gabel *et al.* 2003

Feed Conversion Efficiency (FCE): A Measure of Feeding System Efficiency

- **kg energy corrected milk / kg feed DM consumed**
- **g protein + fat / kg feed DM consumed**
- **Critical elements:**
 - **Milk production & protein and fat concentrations**
 - **Reliable measures of feed DM intake**
 - **Understanding partition of nutrients between milk production & other processes**

Factors Affecting FCE

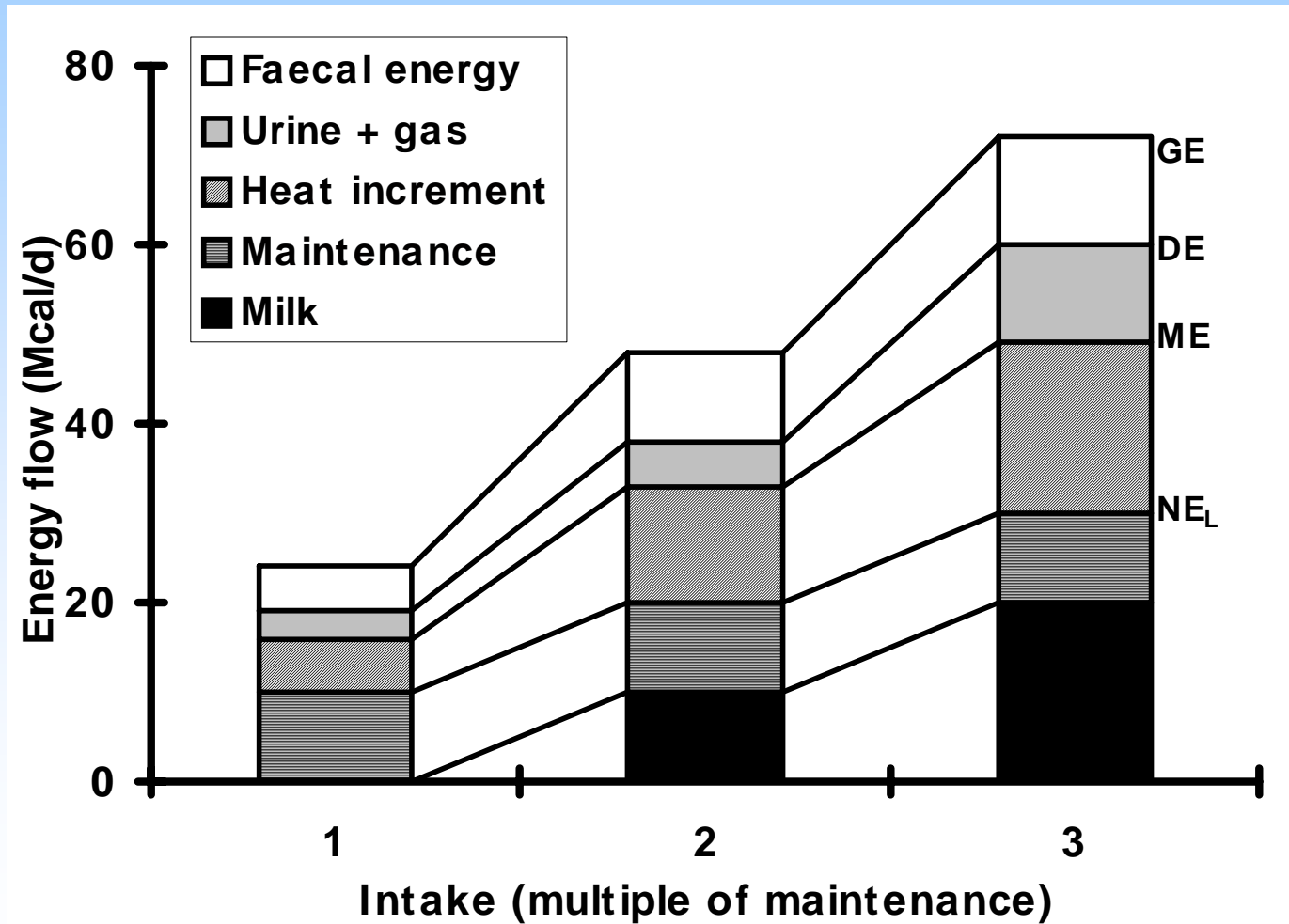
Diet

- **Amount of feed consumed**
- **Conversion of ingested nutrients into absorbed nutrients**

Animal

- **Genetics**
- **Amount of feed consumed**
- **Stage of lactation**
- **Body condition changes**
- **Metabolic efficiency**

Level of Feed Intake & Energy Flow Through a Dairy Cow



Source: Vandehaar 1998

FCE & Stage of Lactation Cows Fed a Mixed Ration

Weeks in milk	DMI (kg/d)	ECM (kg/d)	FCE (kg/kg)	Adjusted FCE (kg/kg)
6	24.1	47.1	1.95	1.80
12	25.3	43.2	1.71	1.67
18	25.1	41.2	1.64	1.74
24	23.7	37.9	1.60	1.75
30	23.3	34.3	1.47	1.66

Source: Beever & Doyle 2007

Grazing vs Mixed Ration Feeding

	Pasture + concentrate	Partial mixed ration	Mixed Ration
Total DM intake (kg/d)	21.6	25.2	26.7
Pasture DMI (kg/d)	12.9	7.5	-
Milk production (kg/d)	28.5	32.0	38.1
ECM production (kg/d)	24.2	28.3	33.6
FCE (kg ECM/kg DM)	1.12	1.12	1.26

Source: Bargo *et al.* 2002

Grazing vs Mixed Ration Feeding

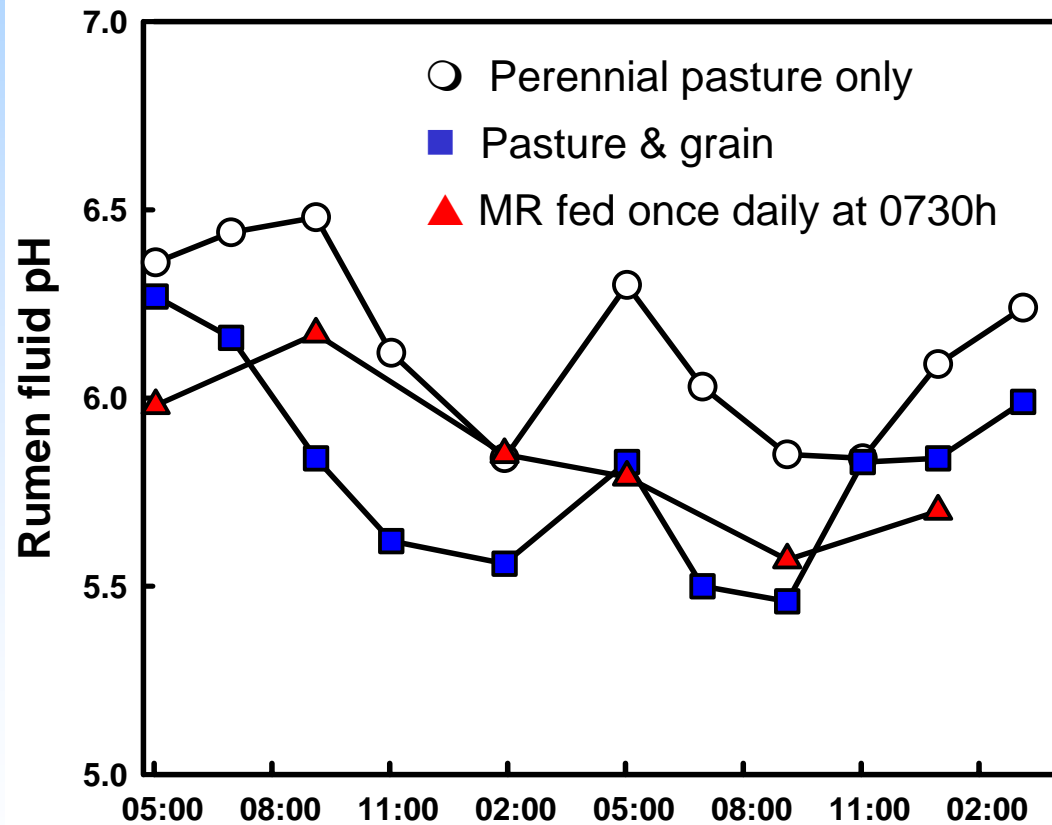
Principles

- **Feed Intake is of Primary Importance**
 - constraints to intake at grazing
- **Efficiency of Rumen Fermentation**
 - synchrony of energy and protein
 - predicting nutrients consumed at grazing
 - sufficiency of fibre - rumen function & rumination
- **On Nutritional Grounds Mixed Rations are Superior**

Constraints to Intake at Grazing



Rumen pH in Grazing & Mixed Ration Fed Cows



Source: Bargo *et al.* 2002; Wales & Doyle 2003

Grazing vs Mixed Ration Feeding

Achievable FCE

- **On a well formulated TMR:**
 - Achievable 1.75 kg ECM / kg DM intake
 - Often lower 1.2 to 1.4
- **In a grazing system:**
 - Achievable 1.4 kg ECM / kg DM intake
 - Commonly about 1.0
- **Note:**

Highest milk production # highest profit

Efficient Use of Supplements in Grazing Systems

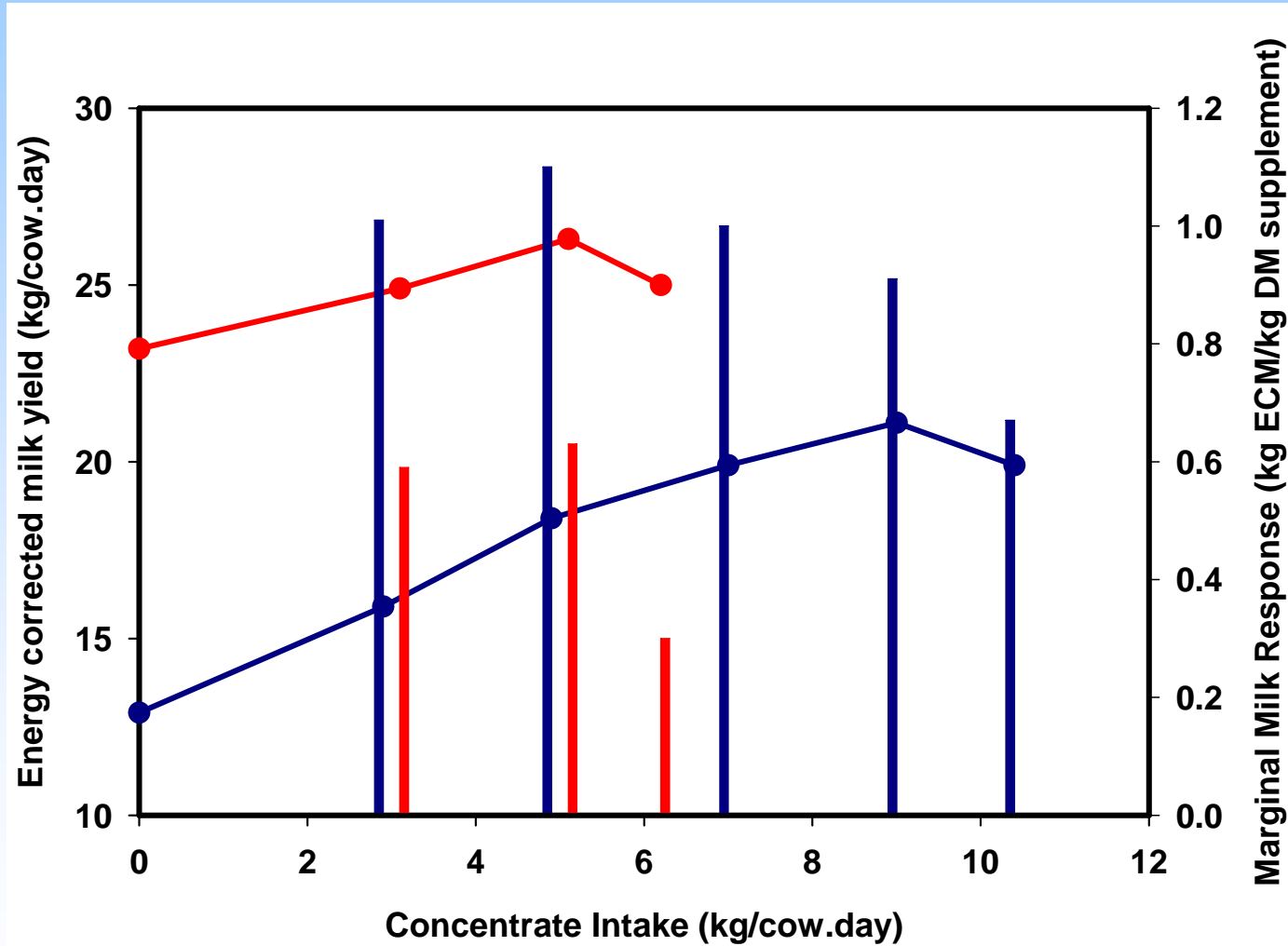
Principles

- **Filling Feed Gaps**
 - Increased carrying capacity / stocking rate
- **Increased per Cow Production**
 - When & why do diminishing returns occur?
 - Substitution
 - Rumen instability / sub-clinical acidosis
 - Associative effects

Substitution and Associative Effects

- **Substitution**
 - the reduction in pasture intake that occurs for each kg of supplement consumed
- **Associative effects**
 - the digestibility (DE) of the diet is lower than the value calculated from the mean of its components

Diminishing Marginal Milk Responses to Supplements



Source: Doyle & Stockdale 2006; Walker *et al.* 2001

Efficient Use of Supplements

Substitution Rates:

- **Increase with Pasture Allowance / Intake**
- **Increase with Amount of Supplement Fed**
- **Higher for Forage vs Concentrate Supplements**
- **Higher on High vs Low Digestibility Pastures**

So what challenges do Australian farmers face in feeding cows profitably?

Farmers' Perceptions of Profit Drivers

People

Management skills/knowledge

Personal goals

Labour availability, quality & efficiency

Operating
environment

Milk price

Cost of production

Capital investment

Seasonal conditions

Feed system &
herd factors

System understanding & complexity

Pasture consumption

Plant systems & water availability

Responses to supplements

Use of technology

Automation

Appropriate infrastructure

Conclusions for Australian Farms

- **Feed costs - 40 to 60% of total costs**
- **Feed efficiency gains are important to profitability & risk management**
 - **declining terms of trade & prices**
- **Diversity & complexity of systems means that advice to farmers needs to be tailored to individual businesses**

So what do farmers need to know?

Key Questions for Profitable Feeding of Grazing Cows

- **How much pasture is grown & consumed?**
- **Do returns from extra pasture eaten exceed costs?**
- **Are supplements used efficiently?**
- **What is the herd feed conversion efficiency (FCE)?**
- **How can FCE be measured & increased - both annual & seasonal?**
- **What are extra returns & costs of increasing FCE?**

All of these are systems questions