

Perennial ryegrass breeding and the scaling issue: A review of systems experiments investigating milk production and profit differences between cultivars

S. J. Hendriks, D. J. Donaghy, L. M. Cranston,
G. R. Edwards and D. F. Chapman



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Small plot studies



Basis of forage variety evaluation



+ \$200/ha

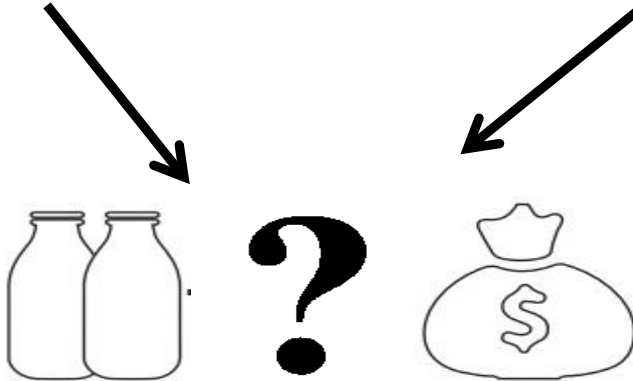


+ \$100/ha

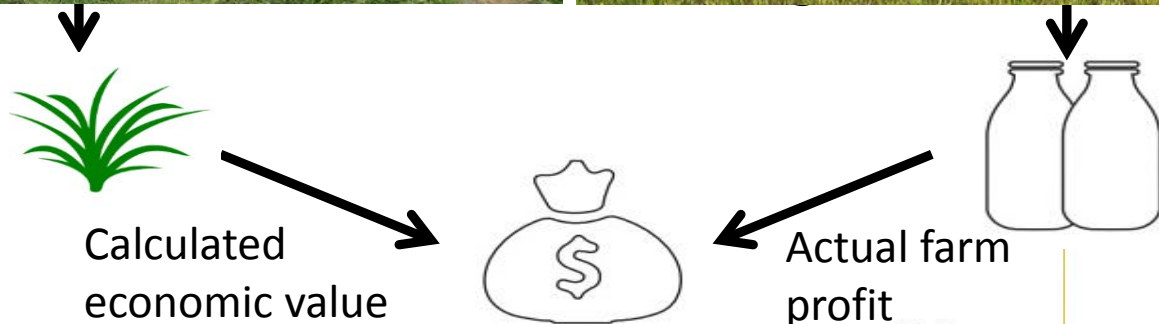


+ \$50/ha

Improvement in dry matter production and quality



Small plot studies vs. Whole-system studies



Objectives

Aim: Identify characteristics for future whole-systems studies

Whole-system review comparing ryegrass cultivars:

- Benefits of breeding on whole-system production and profit
- Develop a framework on which to develop future studies to improve the New Zealand Forage Value Index (FVI)

Whole-system studies review

Criteria for selection for the review:

- Fully self-contained pasture-based dairy systems
- Conducted over multiple years
- Accounted for feed supply-demand balance
- Measured animal intake and/or milk production

Bluett et al. (2005), O'Donovan and Delaby (2005),
Crush et al. (2006)

Comparing 'old' and 'new' cultivars

Crush et al. (2006)

'Old' = Nui, Ellett, Yatsyn; 'new' = Bronsyn, Samson, Aires HD

Economic values and seasonal dry matter yield differences based on the Forage Value Index (DairyNZ 2016)

Cultivar	Nui (1980's)	Bronsyn (1998)	Samson (1998)	Mean difference between 1980's and 1998 cultivars
Economic value (\$/ha)	-253	-175	-90	120
Dry matter yield (kg DM/ha)	-843	-583	-300	400

Note: Ellet, Yatsyn and Aires HD are no longer marketed: no data available from FVI

Differences between wild-type and novel AR1 endophyte

Wild-type endophyte	Novel AR1 endophyte
Lolitrem B and Ergovaline	↓ Resistance to pests
Ryegrass staggers	No effect on animal health
↓ Dry matter intake	No alkaloids produced
↓ Milk production	

Bluett et al. (2005)

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Sward characteristics

- Quantity of harvestable material could increase dry matter intake and milk production (O'Donovan and Delaby, 2005)
- Differences in sward characteristics can have important effects on animal production (Davies *et al.*, 1992; 1993; Munro *et al.*, 1992; Moss *et al.*, 2000; Gowen *et al.*, 2003)

Measurement and management reported for studies reviewed

Variable	Measurements collected in:	
	All studies	Some studies
Pasture productivity	Herbage mass Nutritive value Botanical composition Dry matter yield	Annual herbage accumulation N fixation Herbage accumulation rates Alkaloid concentrations Tiller density Clover growing point density Endophyte status of ryegrass Grass removed
Animal production	Milk yield Milk composition Liveweight	Ryegrass staggers Body condition score Dry matter intake
Financial performance		Economic farm surplus

Crush et al. (2006), O'Donovan and Delaby (2005), Bluett et al. (2005)

Conclusions

- Genetic gains evident due to plant-endophyte interactions and heading date
- There is a need for whole-system studies to be undertaken – ‘validation’ of the FVI
- This will provide valuable information to farmers



Endophyte-plant interactions

Table 2: Endophyte infection levels of 1980's and 1998 ryegrass treatments.

1980's	1998
At sowing	
69%	92%
After 4 years	
88%	96%

1980's: decreased ryegrass tiller density and increased clover content

Crush et al. (2006), Eerens et al. (2001)