Economic Values for Perennial Ryegrass Traits in New Zealand Dairy Farm Systems

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Introduction

Perennial ryegrass (*Lolium perenne* L.) is the main species used in dairy pastures throughout New Zealand. There are approximately 30 perennial ryegrass cultivars sold commercially in New Zealand, but currently there is no evaluation system which allows farmers to compare the potential impact of different cultivars on the profitability of their farm business. Such an economic evaluation system requires information on performance values (PV) for cultivars which quantifies their performance with respect to the major productivity traits (herbage accumulation (HA, kg DM/ha), nutritive value and persistence) relative to a genetic base, and economic values (EV, Doyle and Elliott 1983) which estimate the additional profit resulting from each unit change in the trait of interest (Equation 1).

$$\text{Economic value} = \Delta \text{ operating profit}/\Delta \text{ trait of interest} \quad (1)$$

This paper describes a system modelling approach developed to estimate EV for seasonal HA of pasture in the major dairying regions of New Zealand. This information is used in the DairyNZ Forage Value Index system (www.dairynzfvi.co.nz) which is being developed to include information on all three productivity traits for commercially available ryegrass cultivars.

Methods

The dairy farm system model 'Farmax Dairy Pro' (Bryant *et al*. 2010) was parameterised to represent typical farm management practices and physical production in each of four regions of New Zealand: upper North Island (nominally Waikato), lower North Island (Manawatu), upper South Island (Canterbury), and lower South Island (Southland) (Table 1). Benchmark information for management, production and costs (DairyNZ 2011) plus figures for average monthly pasture HA rate were used for each region. Predicted operating profit was recorded for each base simulation.

Pasture HA was then amended to add 365 kg DM/ha extra pasture HA in winter, early spring, late spring, summer or autumn as a *pro rata* amount relative to the average daily pasture HA. Thus for example, if total average HA in early spring (defined as encompassing all of July and August in the North Island regions) was 2000 kg DM/ha, then daily pasture HA rates were increased by 18% (365 as a percentage of 2000) over the 62 days of the early spring period. Tactical management policies such as hay/ silage conservation policy, pasture offered, and the feeding of forage supplements were then adjusted to ensure that the additional feed was used efficiently within a season. The 'new' simulation was accepted if key system indicators such as average pasture herbage mass and animal body condition score matched those of the base simulation (*e.g.* Chapman *et al*. 2011). The new operating profit was then compared to the base operating profit using equation 1.

Table 1. Management and physical production details for 'base' dairy farm systems in four regions of New Zealand as simulated in the dairy farm system model 'Farmax DairyPro'.

	Upper North Island	Lower North Island	Upper South Island	Lower South Island
Effective milking area (ha)	106	91	200	171
% milking area irrigated	0	0	100	0
Stocking rate at peak (cows/ha)	3.05	3.05	3.43	3.28
Milksolids (kg/ha)	1,003	1,018	1,359	1,228
Milksolids (kg/cow)	329	333	396	374
Lactation length (days)	262	256	271	254
Supplements as % total feed eaten	15	10	17	10
Nitrogen applied as fertiliser (kg/ha)	140	118	201	157

Results and discussion

There was a general trend for declining value of summer and autumn pasture HA moving from north to south (Table 2). Extra feed was most valuable in early spring and

Table 2. Economic values (NZ$/kg additional dry matter) for seasonal pasture herbage accumulation in dairy systems in four regions of New Zealand for the 2012/13 season.

Season*	Upper North Island	Lower North Island	Upper South Island	Lower South Island
Winter	0.29	0.37	0.43	0.39
Early spring	0.46	0.46	0.40	0.44
Late spring	0.19	0.15	0.29	0.22
Summer	0.39	0.32	0.16	0.10
Autumn	0.40	0.31	0.28	0.25

* Winter = May and June (North Island) and June and July (South Island), Early Spring = July and August (North Island) and August and September (South Island), Late Spring = September and October (North Island) and October and November (South Island), Summer = November to January (North Island) and December to January (South Island) and Autumn = February to April (North Island) and March to May (South Island).

autumn in the upper North Island, and in winter and early spring in both South Island regions. There was very little difference in the seasonal value of feed when comparing the upper and lower South Island regions.

Regional and seasonal differences in the estimated EV of additional pasture HA reflect differences in pasture HA patterns (*e.g.* Radcliffe and Baars, 1987) which, in turn, influence major strategic farm management decisions such as stocking rate and time of calving (Holmes et al. 2002). The consistently high EV for early spring growth across all regions (Table 2) is driven by the general occurrence of a pasture feed gap between the start of calving (typically early July in the North Island and early August in the South Island) and mid spring. If extra feed is available from pasture during this period, there are positive benefits for milk production, average herbage mass and HA, cow condition, and supplementary feed use, all of which translate directly into financial performance.

Conclusion

Region-specific EV are required for the pasture HA trait in an economic pasture evaluation index, since the seasonal pasture growth curve differs between the regions, as does the timing of feed deficits and surpluses. Extra feed from pasture will be most valuable if it is utilised directly by grazing animals to fill a feed deficit.

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