Determining the value of pasture renewal to a dairy farm system in the 2009-2010 Season.

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Abstract

Information was gathered from dairy farms in four regions of New Zealand for the season ending May 2010. The regions were Waikato, Taranaki, Canterbury and Southland. Two farms were selected from each region, one that had undertaken regrassing on a regular basis for at least five years (Modern Varieties, MV) and the other had not undertaken any regrassing in the previous decade (Traditional Varieties, TV). A computer simulation tool (UDDER) was used to model the effect of regrassing on these farms. In three regions, MV generated more milksolids/ha and a greater net farm margin compared with TV. The use of computer modelling allows farmers to make a decision based on the data from their own property rather than rely on data that is sourced from different growing conditions.

Keywords: regrassing, modern varieties, traditional varieties

Introduction

The impact and value of the new pasture varieties on the whole farm dairy system has been examined by Stevens & Knowles (2011), and Brazendale *et al.* (2011). At a strategic level the report commissioned by the Pasture Renewal Trust (Sanderson & Webster 2009) has placed a potential economic value of pasture renewal on dairy farms at $6.629 billion. Such values, generated from extrapolated data are difficult for farmers to use for the impact on their property or to appropriately apply monitored research station data to another district. This paper attempts to quantify the benefits an individual farmer would receive on their farm with their own data using the established research relationships in the UDDER model if they were to undertake a planned pasture renewal programme on a sustainable basis.

In the current economic environment, farmers are looking for strategies to improve their profitability per unit of grazing area. One outcome resulting from this search was the symposium set up by the New Zealand Grasslands Association in 2011 to discuss issues surrounding the persistence of the new varieties in a whole farm system. The factors affecting persistence of the modern varieties can be managed by having appropriate management decisions at the critical periods of the season when the pasture is under stress (Macdonald *et al.* 2011). It is important that a farmer has confidence in a pasture renewal programme so that the maximum value can be obtained from the investment in regrassing.

Many pasture production trials show the benefit of the new varieties compared with other varieties in a pure sward (Hume *et al.* 2007; Westwood & Norris, 2000, 2001). However, if a farmer is only regrassing 5% of their farm, what value does this contribute to the total farm system? Kelly *et al*. (2011) reported on a survey in the Waikato and Bay of Plenty to assess farmer attitudes to pasture renewal. The survey showed that while the farmers were confident in carrying out the actual regrassing process and obtaining a successful result, they were unsure of the improvements made in the selection of the variety and the benefits of having this variety in the pasture after grazing it for several years.

Measurement at a dairy farm south of Te Awamutu showed an increase in dry matter yield and digestibility of renewed pastures compared with "old" established pastures over two years (Glassey *et al*. 2010).

DairyBase collects financial information from dairy farms throughout New Zealand. An unpublished comparison was carried out by the author of the financial results for farms that had recorded as spending on regrassing, and those that had not undertaken any spending on regrassing. There were 21 farms in the non-regrassing group and over 60 farms in the regrassing group. This showed that, for farms at a similar level of feed input, farms spending on pasture renewal were less profitable than those not carrying out any pasture renewal. The reason for this outcome is likely to be multi-factorial including lack of implementation skills and understanding for intensification of a whole farm system to increase financial returns.

The research reported in this paper was commissioned by the Pasture Renewal Trust which is interested in assessing the value of a pasture renewal program on a whole farm system that is sustainable. Farmers are looking for strategies to improve the performance of their businesses while exploiting the natural advantages of the local environment. The UDDER modelling programme was used to test if pasture renewal increases pasture quantity and quality fed to milking cows, this being a key component to successful intensification of a dairy farm.

Material and Methods

This project used UDDER, which is a computer simulation tool for dairy farm systems that predicts responses to changes in management strategies (Larcombe 1989, 1990) where the major food supply is pasture.

UDDER predicts the flow of energy within a single dairy production system by calculating the consumption and output of energy by different classes of livestock (Hart *et al.* 1998). UDDER works in 10-day units and requires data on farm size, stocking rate, calving and drying off patterns, management of dry stock, grazing management (rotation length), supplementary feeds and cropping. Each of these factors can be modified for new simulations. It is possible to adjust the pasture quality, height mass relationships and cow potential parameters to ensure the production levels achieved under the simulations were similar to those actually recorded on farms.

UDDER predicts the expected milk production of a herd under different conditions of management and pasture growth. It can also be used to calculate the energy requirements of a herd provided the milk production and body condition of the cows are known.

It has been used in the New Zealand dairy industry since 1991 and allows users to answer questions such as "what happens to per cow and per hectare annual milk production if the stocking rate is changed from 3.5 cows per hectare to 2.5 cows per hectare and what economic change occurs?"

Information from two dairy farms in the Waikato region for the season ending May 2009 was used initially, then the study was expanded to include eight dairy farms from four regions in New Zealand for the season ending May 2010. The regions used were Waikato, Taranaki, Canterbury and Southland, as they represent the majority of the dairy production in New Zealand. Two farms were selected from each region, one that had undertaken regular regrassing for at least five years (MV) and the other had not undertaken any regrassing in the previous decade (TV). It was attempted to get the farms in close physical proximity to each other so that the difference in external factors such as rainfall could be minimised. The soil types and base fertility were accepted as being equivalent within the region.

The Waikato MV farm undertakes the Programmed Approach™ to regrassing as described by Lane *et al.* (2009). This means that the interval between regrassing events is eight years between commencing the regrassing program and the need to re-grass again. On this farm the perennial pasture sown was a tetraploid ryegrass/white clover mix at the standard rate with endophyte protection. Two years prior to planting the perennial pasture a short rotation ryegrass/chicory mix was sown (autumn year 1). After eighteen months (spring year 2) a brassica crop replaced the short rotation ryegrass/chicory mix as a method to establish a clean seed bed for the perennial pasture to be sown in autumn year 2.

Both Waikato farms were modelled on UDDER using the actual farm data. The modelling process uses known inputs to build a farm model. Where components of the farm strategy that are not known, a compromise is reached with the best combination of unknown factors that allows the predictions to fit the known data. The outputs of the models were checked with the farmers to make sure that they resembled the reality that occurred on farm. A good farm model will have a strong relationship between the predicted outputs and the actual that occurred on farm.

The calculations that UDDER uses to predict outputs are derived from relationships developed by grassland research experiments, and shown by MacDonald *et al.* (2011) to be as effective as traditional farm management decision rules. The model starts by predicting a feed wedge that is available to feed the stock in that ten day period. This feed is converted to energy which is available to the cows to use for milk production, maintenance and pregnancy depending on the time of season.

Once each farmer had confirmed that this model represented their farm performance for the season, all feed inputs in the form of supplements were removed from the model, leaving pasture as the only source of feed on the farm. The modelled farms are assumed to be milking platforms only, and not carrying replacements on the farm. The removal of the feed inputs at critical times of the season changes the amount of energy available for milk production and body condition score profile. As a result of this process the each farm will have a new stocking rate that can be sustained by the amount of energy supplied by the pasture grown. The objective of the new stocking rate on each farm is that the body condition score at the end of the season is the same as the start of the season. In this manner the long term energy use of the strategy is balanced on a sustainable basis. The differences in stocking rate and milksolids production between each farm, paired by district, can be then be attributed to the productive value of the pasture that the cows were grazing.

The predictions generated from MV and TV were compared. A net farm margin (NFM) was calculated by subtracting from the milksolids revenue generated by each management strategy the direct costs of harvesting the milksolids. These direct costs include animal health, breeding, shed expenses and the employing of staff to milk the cows.

In all of the strategies reported the milk price used was equivalent to $6.50 per kilogram milksolids (MS).

Results and Discussion

Waikato

The results from the paired Waikato MV and TV farms over two consecutive seasons (Table 1) showed that the advantage for the Waikato MV farm was $460 per hectare in 2009 and $270 per hectare in 2010 after all expenses were covered.

The difference in the stocking rate between these farms in the two seasons (Table 1) is minimal but the milksolids production is 11% and 7% greater from the MV for each of the seasons. The model has predicted increased milk production would occur, as there was more energy available from new pasture. The seasonal characteristics for the 2008/2009 and 2009/2010 seasons in the Waikato were an average start to the season but a very dry autumn and very late autumn rains. The consequence of this was that the MV grew faster than TV at the start of the season. This allowed the pasture covers (kg DM/ha) to build up. Once the stress of the dry period started to have an impact on grass growth the stability of the TV maintained the pasture covers at a higher level compared to the MV as predicted by the model. This observation was consistent over both seasons the farms were modelled.

Figures 1, 2 & 3 show model predicted pasture growth rates, pasture covers and pasture digestibility from the two farms through the 2009-2010 season. All of the inputs that were used to assist the actual milksolids production have been removed so that the only factor delivering the new milksolids production is the predicted pasture outputs. The predicted grass growth rates generated by the models indicate that the MV is expected to grow around 20% faster than the TV through the early part of the season. The difference in the growth rates of the MV and TV farms over the summer period was minimal. As the autumn conditions allowed pasture growth the advantage to the MV pastures returned to a 20% advantage over the TV pastures.

Fig. 2 shows that the pasture growth rates of the MV pastures allow the pasture cover to build up through the late spring and set up the summer milksolids production. This build up of cover is consistent with the results reported by Glassey *et al.* (2010).

In Fig. 2 average pasture covers were approximately the same amount of dry matter in late November. The predicted digestibility of MV is higher than TV through the bulk of the season (Fig. 3). This advantage is consistent with the data presented by Glassey *et al.* (2010) where the pasture digestibility of new pastures was measured over two seasons. This quality advantage combined with the extra pasture cover through the season will allow the cows to have a greater choice of pasture to consume. This choice will allow cows to consume more energy and consequently improve milksolids production. The improvement in the digestibility of TV pastures in March coincided with February rain and is a response to the higher pasture cover at this stage of the season. This response diminishes from March as a result of the TV pastures being grazed as hard as the MV.

The predicted farm milksolids (Fig.4) are solely derived from the ability of the cows to consume the

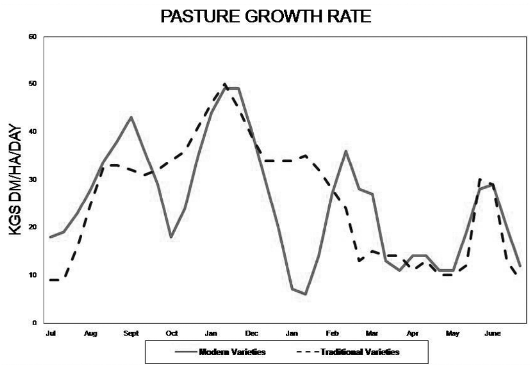

Figure 1 Predicted pasture growth rates (kg DM/ha/day) on the two modelled Waikato farms over the 2009 -2010 season.

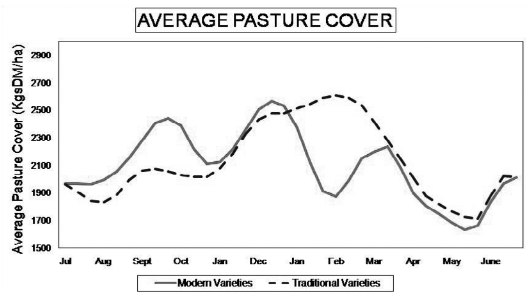

Figure 2 Predicted average pasture cover (kg DM/ha) for the two modelled Waikato farms over the 2009-2010 season, assuming the pasture growth rates shown in Figure 1.

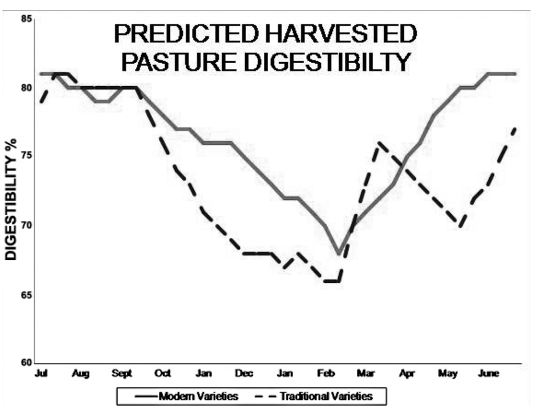

Figure 3 Predicted harvested pasture digestibility for the two modelled Waikato farms over the 2009-2010 season.

Table 1 Modelled production and margin values for two farms in the Waikato region when Modern (MV) and Traditional Varieties (TV) of pasture were grown in consecutive seasons (2008-2009 and 2009-2010)

Season	2008-2009			2009-2010		
	TV	M V	Difference	TV	MV	Difference
Stocking rate (cows/ha)	2.30	2.30	0%	2.33	2.30	(1%)
Milksolids production (kg/ha)	606	676	11.5%	660	710	7.5%
Margin/ha	$2840	$3300	16%	$3300	$3570	8%

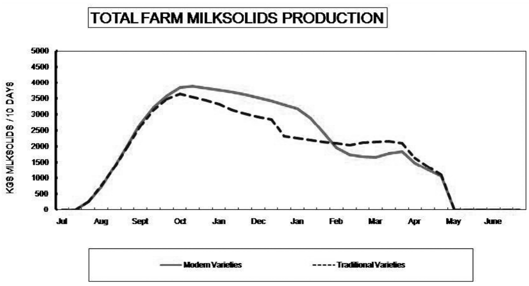

Figure 4 Predicted milksolids production for the two modelled Waikato farms over the 2009-2010 season.

pasture and convert it to milksolids. The predicted curve for the MV model indicates that they will outperform the TV up to the mid-summer period. Once the pressure of summer growing conditions occurred then the TV were able to outperform the MV on a daily basis. However this advantage was not sufficient to make up for the superior performance prior to Christmas.

Taranaki

The predictions for the two Taranaki farms follow the same pattern as the Waikato farms. The TV farm was able to carry a higher stocking rate (Table 2) as the pasture covers through the critical times of the season allow all of the cows to be fed at an adequate level. The superior digestibility of the modern varieties allowed the cows in this farm model to produce more milksolids through the season. The majority of the margin comes from the extra milksolids production but the margin also includes the cost of carrying extra cows through the season.

Canterbury

The Canterbury farm models (Table 3) again highlight the benefit of the pasture renewal. The base model for Canterbury assumes that the herd is grazed off the farm for the winter period and arrive on the farm at the start of calving. The farms are fully irrigated through the season. Both farms are able to start the season at a similar cover of 2300 kg DM/ha. The advantage of the renewed pasture in terms of yield and improved quality allows a higher carrying capacity through the season

Table 2 Modelled production and margin values for two farms in Taranaki when Modern and Traditional Varieties of pasture are grown.

	T V	M V	Difference
Stocking rate (cows/ha)	2.78	2.68	(3.6%)
Milksolids production (kg/ha)	880	940	7%
Margin/ha	$4455	$4890	9.8%

and each individual cow carried is predicted to produce more than the ones in the traditional strategy. The advantage to MV gave an increase of 21% in margin ($1260/ha).

The model predicts that the grass growth under irrigation through the late spring and early summer will be superior for the MV farm. It is this advantage that is translated into milksolids production.

Southland

The Southland predictions were not as definite (Table 4). This was due to the underlying farm management programme in Southland where the majority of farms have a winter crop for the cows. This is equivalent to about 5% of the farm. Once the spring growth occurs the climatic conditions allows the cows to perform at an optimal level through the whole lactation season. This environment also allows pasture to grow with minimum impact from factors that reduce performance. The MV farm in this environment had a 10% pasture renewal compared with the TV farm where 5% was replaced.

The predicted responses indicate that the advantage to MV seen in other regions where the summer grass growing environment placed the pasture under stress has been negated. A conclusion drawn is that regrassing more than 5% of the farm under Southland conditions is unnecessary. The pasture growth and quality on the farms are not subjected to the pressures experienced in

Table 3 Modelled production and margin values for two farms in Canterbury when Modern and Traditional Varieties of pasture are grown.

	TV	MV	Difference
Stocking rate (cows/ha)	2.55	2.73	7%
Milksolids production (kg/ha)	1190	1410	18%
Margin/ha	$6010	$7270	21%

Table 4 Modelled production and margin values for two farms in Southland when Modern and Traditional Varieties of pasture are grown.

	TV	MV	Difference
Stocking Rate (cows/ha)	2.38	2.83	(2%)
Milksolids production (kg/ha)	1060	1025	(2.5%)
Margin/ha @$6.50/kg MS	$5110	$5050	(1%)

the other regions reported.

Discussion and Conclusions

While the modelling is limited to just two farms from each region, and just 1 year for three out of four regions, the modelling provides further evidence of gains made in energy supplied from renewed pasture on dairy farms. This is adds to the evidence of Glassey *et al.* (2010) where gains from new pasture in terms of dry matter yield and metabolisable energy over several seasons were reported. Confidence in the UDDER model to predict this is provided by MacDonald *et al.* (2010), and by the ability of the UDDER model to accurately predict actual production on the tested farms in the base scenarios.

The results of a survey (Kelly *et al*. 2011) to look at farmer attitude to pasture renewal indicated that farmers are confident about their ability to carry out the physical activities associated with regrassing. This is supported by results from the model's prediction, that renewing pastures allows farmers to improve their performance using the skills that they currently have.

The decline in cover through the summer could be expected as the newer established pastures will react to the stress of summer drought faster than a traditional established pasture. The root structures of the young pastures are not sufficiently established to capture the moisture required to maintain growth. The young pastures will also have bare patches through it where the sward has not completely closed over.

The outcome from the modelling process was the value determined from incorporating a regrassing programme into a whole farm system. The use of computer modelling allows the early adopting group of farmers to make a decision based on the data from their own property rather than rely on data that is sourced from different growing conditions. For the farms modelled north of Southland, the MV farms generated more milksolids/ha and a greater net farm margin. An important factor in this positive result is the improved pasture quality at the critical milksolids production periods. In regions where grass growth patterns are subject to pressure, return of at least 8% on earnings before interest and tax (EBIT) on revenue generated can be attributed to the value of implementing a planned pasture renewal programme. The modelled results of the Southland farms indicate there is little advantage implementing a regrassing program to improve pasture performance through a season. There will still need to be some regrassing required to sustain a winter feed plan.

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