Addressing on-farm management to enhance pasture productivity and persistence

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Abstract
Following the 2007/08 drought, we experienced poor pasture production and persistence on our dairy farm in north Waikato, leading to decreased milksolids production and a greater reliance on bought-in feed. It is estimated that the cost of this to our farming operation was about $1300 per hectare per year in lost operating profit. While climate and black beetle were factors, they did not explain everything, and other factors were also involved. In the last 3 years we have changed our management strategies to better withstand dry summers, the catalyst for which was becoming the DairyNZ Pasture Improvement Focus Farm for the north Waikato. The major changes we made were to reduce stocking rate, actively manage pastures in summer to reduce over-grazing, and pay more attention to detail in our pasture renewal programme. To date the result has been a reduced need for pasture renewal, a lift in whole farm performance and increased profitability.
Keywords: Focus farm, over-grazing, pasture management, pasture persistence, profitability

Introduction
My wife Raewyn and I have operated a 154 effective ha dairy farm 15 km northeast of Hamilton since 2003. We run a seasonal spring calving operation, milking 500 cows, averaging 1110 kg MS/ha over the last 10 years. Under the industry production system definitions (DairyNZ 2012) our farm would be best described as "System 3", and over the year we aim to feed stock on about 80% home grown feed, the remainder made up of mainly palm kernel extract (PKE).

Average rainfall in Ruakura, about 14 km away, is 1118 mm per annum (NIWA 2013), and we farm on a well-drained consolidated Kaipaki peaty loam with a history of poor resilience to summer dry spells.

In the 2007/08 summer, rainfall was only about 42% of the long term mean (Table 1). Combined with high black beetle (*Heteronychus arator*) numbers (Bell *et al.* 2011), this had a severe effect on both our profit and pastures. We were at a point of despair, as were many others in our area. A survey of north Waikato dairy farmers in 2009/10 found that pasture persistence was their No. 1 issue with 75% rating it as important or extremely important (Tarbotton *et al*. 2011).

In response to the widespread dissatisfaction with pasture persistence, DairyNZ asked us to be their Pasture Improvement Focus Farm for the north Waikato, which was the catalyst for us making significant changes in the way we operate our farm system, particularly to better handle dry summers.

Pasture production trends
We have estimated total annual dry matter (DM) production using a rising plate meter (RPM) on year-round weekly farm walks since we started farming the property in 2003, with 10 years of data now accumulated.

Our best pasture DM production was in our first season 2003/04 at 18.6 t DM/ha, which followed two wet summers. This greatly contrasted with poor pasture growth in the three seasons 2008/9 to 2010/11, following the 2007/08 drought, when the farm grew only 11.5 to 12.1 t DM/ha/year (Table 2), despite above average rainfall (Table 1), even though 43% of the farm had been direct-drilled in autumn 2008 (Table 3). In these three seasons we created a "crunch point" in our farm system where we were renewing large areas of run-out pastures in autumn, at the time when our feed supply was at its lowest, and we were not able to achieve our 1 June average pasture cover target of 2400 kg DM/ha. With pasture being our dominant feed, milksolids production suffered, in spite of purchasing increased quantities of imported feeds, mainly PKE.

Over the three seasons from 2007/08 to 2009/2010 the loss in operating profit of the farm due to lower milksolids production and increased costs of imported supplements and extra pasture renewal was estimated to be approximately $1300 per hectare per annum.

Causes of poor pasture performance
Climatic conditions alone did not seem to explain the decline in pasture DM production or the lack of persistence of newly sown pastures we were experiencing. The Waikato region, and our farm, has been suffering a sustained black beetle outbreak since 2007/08. That explained much of the persistence problem with newly renovated pastures, given that predominantly perennial ryegrass cultivars with AR1 endophyte were sown until 2009. But our older, well

established standard or "wild" type endophyte pastures, while showing good persistence under black beetle attack, were also not yielding as expected.

Focus farm

When DairyNZ asked us to be their Pasture Improvement Focus Farm for the north Waikato we agreed. We were expected to host a number of field days, to share our experiences and data, and look to improve the resilience of our and other dairy farms to summer dry conditions.

The initiative was farmer led, with the organising committee also including seed company agronomists, farm system scientists and farm consultants.

The first field day held on 23 February 2011 was attended by farmers, seed company representatives, farm consultants and bankers. While everyone takes different ideas from an event, a key message for us was about over-grazing pastures in summer, how it can damage pasture, and possible strategies to avoid it. "Over-grazing" was defined as grazing to less than 7 "clicks" or half centimetre units of the RPM, or about 5 cm of actual pasture height, at any grazing.

Our policy had been to allow post-grazing residuals to decline to 6 RPM units before supplementing, to avoid substitution and maximise the response to supplementary feed. Furthermore, in dry summers we were grazing to between 5 and 6 RPM units over successive grazings.

Table 1 Summer rainfall (for December, January and February combined) in mm and as a percentage of long term mean (247mm) for 2007/8 to 2012/13, at Ruakura (NIWA 2013).

Year	Rainfall	% of mean
2007/08	103 mm	42%
2008/09	341 mm	138%
2009/10	275 mm	111%
2010/11	334 mm	135%
2011/12	379 mm	153%
2012/13	151 mm	61%

Being the second generation on this property we had the benefit of some historical production data. Analysing this, we believed a pattern was observable. Farm milksolids production consistently peaked after one to two good summers, and had historically taken up to 5 years post-drought to recover to previous levels. Our farm was also slow to respond to drought breaking rains, which we had put down to our peat soils being hydrophobic.

Could changing our grazing management help overcome our pasture performance issues? Unlike rainfall or black beetle, both outside our control, grazing management could be changed.

Preventing over-grazing

Starting in March 2011 we made a philosophical change in our summer management strategy. We reduced stocking rate from a peak of 3.6 down to 3 cows per hectare (at a cow liveweight of 430 kg), and set a target for minimum pasture residuals of 7 RPM units, with a plan to use supplements as necessary to achieve this, through positive feed substitution.

This was different from previous summer feed deficit periods, when we used our pastures and stock to buffer against climatic volatility, allowing cow intakes and performance to drop, and pasture to be grazed to low levels.

Since we changed our summer strategy, the last three summers have been quite different.

Overall 2010/11 was a reasonable summer, although we did encounter a dry spell for 4 weeks. Rather than graze below 7 RPM units, we identified our worst performing 8 hectares and used that as night breaks. Cows were allocated fresh pasture during the day, and received supplements on the sacrifice paddocks at night. Minimum residual targets were achieved, as well as cow intake targets.

The summer of 2011/12 was a wet one, so we were able to meet residual targets without the use of sacrifice paddocks.

Table 2 Estimated pasture production (t DM/ha), milksolids production (kg MS/ha) and difference in Operating Profit ($/ha) from Waikato owner operator district average, 2007/08 to 2012/13

Year	Annual pasture production t DM/ha	Annual milksolids production kg MS/ha	Difference in farm Operating Profit from Waikato district owner operator average
2007/08	12.2	1010	+$236/ha
2008/09	11.5	1022	-$412/ha
2009/10	11.5	959	-$15/ha
2010/11	12.1	990	-$410/ha
2011/12	18.3	1379	+$287/ha
2012/13	14.7	1271	

The drought of 2012/13, with summer rainfall only 61% of the average (Table 1), was the first real test of our new summer strategy. Pasture growth rates through January to March were only 63% of our long-term average. We were able to use supplements to keep residuals above 7 RPM units until 15 March, but with March growth rates averaging only 8 kg DM/ha/day (compared to an average of 18 kg DM/ha/day) pasture intakes declined to the point where over-grazing was inevitable, even with intakes of >90% supplements. The strategy at that point was to minimise over-grazing, by looking after as much of the farm as possible, to maximise pasture survival and regrowth with autumn rains. From 15 March to 19 April we only grazed cows on the poorest performing pastures on 10% of the farm, and allowed the remaining 90% to sit dormant. Grazing of the rest of the farm did not begin until after rain arrived *and* there was an average of 2½ new leaves per tiller, deemed to indicate the point when plant reserves have been replenished and a pasture is ready to be grazed with maximum regrowth speed (Fulkerson & Donaghy 2001).

Better pasture establishment

Part of the Pasture Improvement Focus Farm project looked at improving the establishment of new pastures, as stronger, healthier pastures are better set up to persist.

In our operation we made three changes. The biggest change was to use only perennial ryegrass cultivars with an appropriate endophyte, in our case either AR37 or NEA2. We adjusted our seed sowing rates down from 20 kg/ha to 16 kg /ha for diploid perennial ryegrass to improve plant survival through the first summer. Finally, we changed from applying broadleaf herbicide sprays after the first grazing, to 4–6 weeks after drilling, to improve our kill rate on the smaller weeds.

Results

The 2011/12 season saw a lift in milksolids production of 39% (Table 2) over the previous season. Our Operating Profit went from $410/ha below the Waikato District Owner Operator average (DairyBase 2013) in 2010/11 to $287/ha above in 2011/12 (Table 2). While the increase in productivity was pleasing, we also expect the benefits of preventing/minimising over-grazing to accrue over a number of seasons, and to show up as better pasture persistence and DM yield.

We believe the benefits of our new summer management strategy were seen in the 2012/13 season. While it is very hard to compare between seasons, two factors of pasture performance were quite different from previous dry years. Firstly, only 4.7 ha of pasture renewal was undertaken, and all on "sacrifice" paddocks where stock were held, whereas after previous dry summers we needed to re-sow up to 65 ha (Table 3). While we are only 3 years into our new strategy, we believe persistence of new pastures has improved, and we have moved from expecting to re-sow renovated pastures within three years, to now having only re-sown 8% of the area initially renovated in the last 3 years.

Secondly, our April and May 2013 pasture growth rates were the highest we have experienced (Table 4), and resulted in us not being able to control pasture with stock. We believe that this was due to the combination of protection of pastures from over-grazing, a favourable autumn and aggressive use of nitrogen.

Conclusion

In the last three seasons we have learnt the importance of considering both pasture utilisation and persistence in both our farm strategy, and our day-to-day pasture management decisions. We have added "pasture condition" as a tool to our pasture management Key Performance Indicators to assess what areas require pasture renewal.

Our confidence in the improved performance of our pastures has improved to the extent that we have increased our stocking rate by 10% for the 2013/14 season so that we can utilise more of our pasture grown.

Given the success of eliminating over-grazing we have also added a feed pad to make feeding of supplements easier, and more sustainable for our staff.

In the last three years we have come to believe that for our property, with its free draining soils, over-

Table 3 Area of pasture renewal carried out on farm 2008 to 2013

Year (autumn)	Area of pasture renovated (ha)	% of total farm area
2008	65.8	43
2009	41.5	27
2010	40.7	26
2011	34.1	22
2012	42.4	27
2013	4.7	3

Table 4 Estimated April and May pasture growth (t DM/ha) from 2008 to 2013, and percent of 10 year average

Year	Pasture growth April and May	% of average April and May pasture growth
2008	1.6	89
2009	0.7	41
2010	0.6	34
2011	1.8	102
2012	2.6	147
2013	3.0	166

grazing during summer has caused us significant financial losses, far more so than winter treading or pugging damage. Just as property owners at severe risk of winter pasture damage put in place a range of measures to protect their pastures, we have learned that it is possible, and important, to do the same for our pastures over summer.

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