

Low dry matter content of northern dairy pastures

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Abstract

Pasture of low dry matter content (DM%) can occur in northern New Zealand. From 17 years of monthly pasture sampling on one farm at Kerikeri the DM% in regrowth was equal to or below 13% in more than half the samplings from April to June for ryegrass and ryegrass-kikuyu pastures. The DM% of pasture samples collected just before grazing were below that of regrowth samples (from cages) from April to September, but were higher than these from October to March. This effect was also seen in 9 years of pasture sampling at No. 2 Dairy at Ruakura (near Hamilton in Waikato). During April 1995, DM% of pastures sampled from Awanui in the north to Galatea in the south varied widely from 6 to 15%. Monthly pasture sampling from 2003 on a Ruakaka farm showed a similar seasonal pattern to the Kerikeri farm. On the Ruakaka farm, annual ryegrass pastures had low DM% both in regrowth as well as just before grazing (8% vs 11% in perennial ryegrass). Plantain-ryegrass-clover pastures had consistently 3-6% lower DM% compared with older ryegrass pastures. Factors such as weather, pasture species, and nitrogen fertiliser applications may contribute to low pasture DM% in Northland; this could restrict dry matter intake of cows grazing these pastures and hence milk production. Grazing management and choice of supplements might need to reflect the possible existence of pastures with a low DM%.

Keywords: pasture dry matter content, DM%, Northland, ryegrass, kikuyu grass, clover, plantain

Introduction

Dairy pastures of low dry matter content (DM%) have been encountered across the northern region of New Zealand during on-farm monitoring of pasture production (Piggot 1997), although this subject has rarely been mentioned in the New Zealand pasture literature. This paper presents interesting trends in pasture DM% from the northern region of New Zealand that might have important implications for animal performance and pasture management.

Where used here, the term 'low DM%' refers to pasture dry matter at 13% or below. This distinction is arbitrary but is deliberately chosen to be below the threshold for dairy cows of 15% set by Clark & Woodward (2007), when low dry matter intake could affect milk production. The data presented are a subset

of a larger dataset that is available on request.

Materials and Methods

The data presented were derived from the monitoring of pasture growth on dairy farms in the northern North Island of New Zealand, the primary site being at Kerikeri (Te Ngaio) with continuous monthly DM% measurement since 1992. The Ruakura data are from No. 2 Dairy pastures that were monitored monthly for 9 years from June 1991. Data were also derived from a detailed study of the Paton farm at Ruakaka, south of Whangarei (KAG 2007; Paton & Piggot 2009, this volume).

Pasture sampling was usually between 9 am and 1 pm and during dry weather where possible, but not exclusively. Pasture samples were cut by hand-shears at about 1 cm above ground level and these were stored in bags to eliminate free water before weighing in the field. The field sampling of regrowth was from caged paired sites which had been pre-trimmed by rotary mower at least a month previously, and each comparison mentioned here was from single paddocks unless otherwise stated. Dry matter percentage was derived by drying 100 g pasture sub-samples in a forced-draught oven at 80-90°C to remove all moisture. Occasionally a microwave oven was used to dry the samples. Laboratory dry matter determination was done on the same day as the field sampling. In addition to cage regrowth sampling at Kerikeri, Ruakaka and Ruakura, samples of pasture that was about to be grazed were also collected. The latter samples from the Ruakaka farm were frozen on the day of sampling in a domestic freezer before nutritive value analysis at Hill Laboratories in Hamilton (including DM%). This DM% analysis, by a certified laboratory, provided a check for data derived from drying of fresh pasture samples.

Lack of replication on-farm within years and non-random selection of cage sites precluded statistical analysis.

Results

Seasonal pattern

Pasture regrowth at Kerikeri in ryegrass-dominant and mixtures of kikuyu (*Pennisetum clandestinum*) and ryegrass (*Lolium perenne*) (Table 1) had a low DM% from May to July in over half the recorded years. The pattern was repeated on the Ruakaka farm over 2 years (Fig. 1). Low values for DM% were rare from October

Table 1 The mean monthly DM% for pasture regrowth (in cages) of ryegrass and ryegrass (RG)/ kikuyu mixed pastures over 17 years at Kerikeri from 1993, and for ryegrass pastures at Ruakura for 9 years from 1991, and the number of years when the averages were at or below 13%.

	Ryegrass		RG/Kikuyu		Ruakura	
	Mean	≤13%	Mean	≤13%	Mean	≤13%
May	13.4	12	13.7	11	15.4	1
J	13.1	11	13.0	11	15.4	1
J	15.2	8	14.5	8	16.5	1
A	15.6	2	14.6	7	17.3	0
S	16.1	3	15.2	4	15.3	2
O	17.2	0	16.7	0	16.5	1
N	18.8	1	18.2	1	18.5	2
D	20.4	0	18.9	1	19.6	1
J	21.2	1	19.5	3	21.3	0
F	18.3	1	16.4	4	21.2	1
M	17.0	1	15.4	5	18.2	1
April	14.6	7	13.7	9	14.7	2

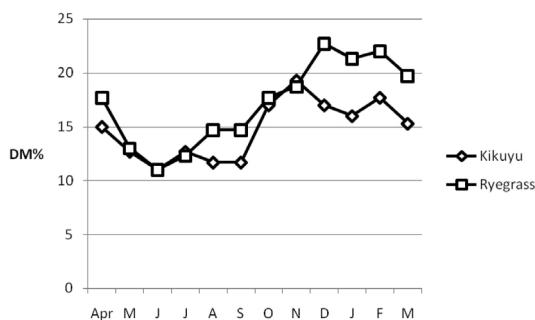
to March. At Ruakura there was no monthly pattern of pasture DM% in the cage regrowth samples (Table 1). During the common sampling period at Ruakura and Kerikeri (from May 1992 for 8 years) the 96 samplings of ryegrass pastures just before grazing averaged 17.5% at both sites. The DM% of pasture about to be grazed at Kerikeri, Ruakaka and Ruakura was lower than the regrowth sampled from cages from April to September, but from October to May, at each site, the pre-grazing DM% was higher.

During autumn 1995, the abundance of grass on northern dairy farms led to a widespread call in the popular farming press to continue milking into autumn. However, by winter, there was widespread cow weight loss and this led to lower milk production in spring. On the following northern dairy farms the DM% from visits in mid-April to mid-May was recorded as: Awanui, 12%; Kaitaia, 14%; Aranga north, 13%; Aranga south, 13%; Waipapa, 14%; Kerikeri, 13%; Puhipuhi, 13%; Maungatapere, 16%; Mata, 13%; Waipu, 11%; Ararua, 13%; Kaiwaka, 15%; Te Hana, 14%; Ruakura, 12%; Otorohanga, 10%; Papamoa, 15%; Pongakawa, 11%; Edgecumbe east, 10%; Edgecumbe west, 8%; Galatea, 6%; Opotiki, 7%. (Note: Bay of Plenty samplings took place throughout the day.)

Pasture species

At Kerikeri the pasture containing kikuyu had lower

Figure 1 Average DM% of kikuyu-based or ryegrass-based pastures in cage regrowth over 2 years from April 2004 at Ruakaka.



DM% than the ryegrass-dominant pasture, especially from December to April (Table 1). The annual average composition for the ryegrass-dominant pastures were 76% ryegrass, 5% other grasses mainly *Poa* spp., 17% legume, primarily white clover (*Trifolium repens*), and 2% weeds and dead matter. The kikuyu containing pasture, averaged 25% kikuyu, 49% ryegrass, 10% other grasses, 13% legume, 3% weeds and dead matter over the year; kikuyu presence was primarily in summer and autumn, while the other grasses component was principally *Poa* spp. especially in August and September. At Ruakaka the kikuyu pasture also tended to have lower values of DM% during summer/autumn (December to April) (Fig.1).

Sampling of pastures on the Ruakaka farm also provided examples of low DM% in cage regrowth off annual and perennial ryegrass pastures from May to October in 2004 and 2005, averaging 8.6% for annual compared with 11% for perennial ryegrass. This result was mirrored on the same farm in a small plot ryegrass cultivar comparison under cutting management, where the mean DM% over 9 harvests from June to October 2005 was 11.8% for the Italian ryegrass (*Lolium multiflorum*) cultivar compared with an average of 13.5% (range 13.2 to 13.8%) over all the perennial ryegrass cultivars. The same trend was evident in pasture samples collected just before grazing from July to September on the same farm; annual pasture averaged 9.3% compared with 13.3% for the perennial ryegrass-based pasture, yet there were no differences between the samples when the dry matter was analysed for ME (12.0 MJ/kg DM) and NDF (43%), although crude protein was slightly higher for the annual compared with the perennial (22.7% vs 20.3%). The DM% of the frozen samples analysed at the commercial laboratory were consistently higher than the equivalent samples dried on site, but the differences was less than 1% of DM.

Low pasture DM% may also influence grazing management decisions. Cows grazing newly sown

annual ryegrass in September 2005 with a DM% of 11, on the Ruakaka farm, had to be shifted off this area because of a fall-off in milk production compared with other herds. Pre- and post-grazing residual dry matter estimates made at the time suggested cow intake had fallen below 10 kg DM/day while grazing the recently regrassed area (30% of the farm).

Moorhead & Piggot (2009, this volume) also reported lower dry matter contents (by 3-6% over 3 years of cage cuts) in plantain/ryegrass mixes compared with ryegrass-dominant pastures, and plantain mixes fell to their lowest value of 6% of DM in May and June.

Nitrogen fertiliser

The Kerikeri pasture DM% data (Table 1) may also have been influenced by increasing nitrogen (N) fertiliser usage and consequent changes in botanical composition (less white clover) over the long sampling period. From 1993 to 1997 low rates of N fertiliser was applied in winter (July/August) increasing towards a total of 150 kg N/ha from 2005 to 2009, spread over the whole year. This change coincided with a reduction in the average winter (May) pasture DM% from 15.3% during the early period to 11.5% during the latter period.

Discussion

How important is the issue of pasture DM%? In this paper the data are observational and provide no proof. Much of the commentary is speculative. The differences between the Northland farms and Ruakura are compelling; low values at Ruakura were fewer and unpredictable whereas in Northland low pasture DM% was common in late autumn and winter. From a comprehensive study of the pasture and climate factors affecting milk production at Ruakura, Roche *et al.* (2009) did not consider low DM% to be an important factor affecting intake in autumn/winter, although the pasture sampling techniques were slightly different. Pasture dry matter contents less than 13% during autumn/winter have not been featured in that work or in the results of other New Zealand research (e.g. John & Ulyatt 1987; Thom & Bryant 1996).

Why does feeding the cow low DM% pasture matter? From the dry matter intake viewpoint and looking at the topic theoretically, a cow eating 16 kg DM/day of good quality pasture with a DM% of 16 needs to consume 100 kg, but this increases to 255 kg if the DM% is only 6, as occasionally recorded in northern New Zealand. The harvesting ability of the cow and its rumen volume are not limitless. Without supporting proof, it can only be a suspicion that low DM% seriously restricts intake of Northland pastures. But the example from the Paton project (KAG 2007) and the small-plot cultivar comparisons where the pasture DM% of annuals

were at least 2% below that of perennial ryegrass reflects differences reported by Thom & Bryant (1996) for pastures on No. 2 Dairy at Ruakura; these authors suggested that the lower dry matter content of 'Concord' Italian ryegrass in late winter/spring (August to November) may have contributed to the lower milk production of cows on 'Concord' than those on perennial ryegrass pastures. If low DM% can be proven to restrict cow intake on Northland farms, this might help explain both poor milk production and the difficulty of grazing pastures to acceptable residuals in the winter and spring.

Why do the pastures have low DM%? The Northland climate clearly promotes lush or verdant growth of pasture plants but agricultural factors play a part. Pasture DM% also seems to be influenced by farm management both with the regrassing of old pastures and the use of nitrogen fertiliser. The process of regrassing of old pastures in autumn enhances growth in the new pastures due to the breaking of weed, pest and disease cycles, aeration of soils and the release of soil nutrients. However, new pastures may provide low quality feed if DM% is too low. The data presented here raises questions regarding the choice of species to be sown. Can annual ryegrasses be justified compared with perennial ryegrass, and does the use of plantain mixes need further scrutiny? Is the definition of low DM% species-dependent if the animal production differences of the main pasture types in Northland are primarily influenced by digestion kinetics (Burke *et al.* 2000)? The widespread use of N fertiliser in autumn and also on new pastures sown in autumn may be accentuating a lowering of pasture DM%. With the prevailing lack of pasture research into such subjects in Northland, the only way these questions can be answered is to observe farming practices and be wary.

Is timing a factor? The tendency for low DM% to prevail in late autumn could be considered to be a minor issue for spring-calving dairy herds when drying off dates are looming and the "problem" occurs when pasture is growing rapidly. However, the example provided of the 1995 autumn suggests that "good autumns" may not be what they seem - the poor milk production in spring 1995, widely reported in the farming press, has never been adequately explained. Was the low DM% in the previous autumn the primary cause? For Northland with many autumn-calving herds the inability to reach high per-cow levels of milk production over winter may be partly explained by the low DM% of the pastures allied with extra moisture as dew and rain sitting on the grass leaves at that time of year. Most winter milking herds are fed supplements as determined by the lowest-cost per kg

DM or kg ME, but this may be a flawed strategy in Northland. Grain-based meals may be more valuable for milk production than silages despite similar nutritive value on a DM basis.

Can low DM% pastures be predicted? In Northland the prevalence of warm, wet and overcast weather is assumed to provide the right conditions for lush growth. Although beyond the scope of this paper, the long-term collection of pasture data at the Kerikeri site allied with the presence of a climate recording station on the farm, provides an opportunity for fruitful study of the issue in future. However, using a microwave oven and kitchen scales, a 100 g pasture sample can be dried in ten minutes, so farmers have the power to discover the importance of DM% on their farms for themselves.

Conclusions

Dry matter content of pasture monitored in Northland when compared with Ruakura pastures suggest that Northland has lower values, especially in autumn and winter. It is speculated that the warmer and more overcast weather is the primary cause of low pasture DM%, and that the actual DM% can be influenced by nitrogen fertiliser, regrassing and pasture species choices. It can be theorised that cow performance is being compromised and grazing and supplementary feeding regimes are affected, but no proof is available.

ACKNOWLEDGEMENTS

Michael Guthrie and Bruce Paton are thanked for providing data as is the staff at Number 2 Dairy, Ruakura, and all farmers who allowed their farms to be visited. John Roche provided valuable comments. Some of the data are derived from projects supported by the Sustainable Farming Fund and DairyNZ.

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