

Pasture production of northern dairy farms

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Abstract

Pasture production and pasture and farm management parameters were measured on 53 farms between 1989 and 1996 in Northland, Waikato and Bay of Plenty. The annual data sets are from 135 seasons each beginning before calving – 90 from Northland, 34 from the Bay of Plenty, and 11 from the Waikato, including a farmlet on No. 2 Dairy at Ruakura. Most farms were of the conventional spring-calving system, but autumn calving farms and irrigated systems were also visited. Visits were monthly except for 12 farms with 10 visits a year. Pasture growth was assessed from a trimmed “cage” technique, and from a “whole-farm” technique which involved calculating the growth required to maintain the livestock feeding regime plus any change in farm cover. Annual yield from the cage technique averaged $14.8 (\pm \text{SE } 0.2)$ t DM/ha while the whole-farm yield was 11.4 ± 0.1 t DM/ha or 77% of cage-assessed yield. The difference between cage and whole-farm growth occurred in all months but was greatest in September and from January to May. The range in whole-farm annual yield was large (8.5 to 15.6 t DM/ha), the lowest and highest yields occurring on irrigated farms. Low yields, however, tended to be associated with farms on clay hill country in Northland. Examples are provided for using these data for calculating the farm stocking rate and calving date, and also for comparing the effect of management factors on pasture growth.

Keywords: cage technique, pasture assessment, pasture production, whole-farm technique

Introduction

The New Zealand dairy farmer focuses on growing and efficiently using pasture, and pasture measurement techniques are evolving to meet the demand for credible pasture data. Pasture growth data can be used for planning the management and for indicating the production potential. The traditional source of pasture production data is from cage techniques. Such techniques can be standardised, allowing for comparative research

and extension of pasture technology. From the time of the earliest published data (e.g., annual yields above 20 t DM/ha, Lynch 1953) doubts have been expressed about the actual pasture production occurring within the farm system, as distinct from the potential growth indicated from cage techniques. Arising from the development of accurate pasture yield assessment techniques (Piggot 1986, 1988), a “whole-farm” pasture growth method has been developed by Pasture Assessment Ltd, which aimed to show whether the latent or potential pasture growth indicated by cage technique differed from the actual pasture growth within the farm system.

As a commercial service to farmers and dairy companies, detailed pasture measurements have been made on over 53 farms between 1989 and 1996, mainly in Northland but also in Waikato and Bay of Plenty. A standardised cage technique has been used to measure pasture growth rates. The farm visit has also entailed reporting the pre- and post-grazing pasture yields, farm cover, and cow intakes to directly assist the farmer’s management and to allow the calculation of the actual or whole-farm pasture growth. Other records of milk production, management parameters and climatic data are taken. This paper presents a summary of interesting trends in the pasture production data. Individual farms are not all identified for reasons of commercial sensitivity.

Methods

The measurement process is provided as a standardised service for a full dairy season beginning about or before calving. The service provides technical measurement, not consultancy, thus preserving independence between measurement and interpretation. The data provided here are from varying numbers of seasons per farm from the winters of 1989 to 1996 inclusive. The annual data sets are from 135 season-years; 90 from Northland, 34 from Bay of Plenty, and 11 from Waikato, including farmlets within management experiments on No. 2 Dairy at the Dairying Research Corporation, Ruakura. Individual farms had different numbers of seasons included in the data summarised here. Visits were monthly except for 12 farms with 10 visits per year. Pasture growth was estimated from a “cage” technique and the whole-farm technique.

The cage technique aimed to provide an index of latent regrowth from the farm. (The potential growth was not measured in the manner of Piggot *et al.* 1986 because the cutting interval was fixed by the visit timing and was mostly monthly.) A site for cages was chosen by the farmer, which had above-average productivity for the farm, had typical species, but always had ryegrass and white clover. The site for cages (usually 4) was trimmed by rotary mower at approximately 10 mm and was re-trimmed the following month. If the pasture was sufficiently dense and above mower height at trimming the cage was cut at the next visit to assess pasture growth using $2 \times 0.25\text{m}^2$ quadrats per cage from 2 cages. The fresh yield was weighed by triple beam balance on-site and sub-sampled for dry matter content and species composition.

The whole-farm technique has two parts: (1) calculation of the change in farm cover between monthly visits and (2) calculation of the daily growth required to equate with the livestock pasture intake. The data required are the pre- and post-grazing paddock yields under rotational grazing. The paddock estimates were assessed on representative transects by eye, apart from occasional use of a plate or probe where dictated by the farmer, and were always calibrated by cutting. In this paper all the data were derived solely from the author's farm visits. The theory behind the calibration technique using trim DM yield plus an arbitrary stubble value is described in Piggot (1988). The technique aims to provide pre- and post-grazing yields with an error less than 100 kg DM/ha. Cow intakes are calculated from the difference between the pre- and post-grazing DM yields divided by the daily grazing pressure as cows/ha. Farm cover is calculated based on the averaging method (Piggot 1986). A number of rules apply to stubble yields, deletions from the milking area, intakes of minor mobs of stock, and so on. These and further details concerning the techniques are available on request.

Results and discussion

Annual pasture yields (Table 1)

Although they are included in the Waikato yields, the data from No. 2 Dairy at Ruakura were – 1992 and 1993 years from the Control farmlet in the Comparison of Pasture Species trial: cages 14.8 t DM/ha, whole-farm 12.9; 1994 to 1996 years from 200N farmlet at similar stocking rate to the 1992 and 1993 data: cages 16.9, whole-farm 15.2. Averaged over all the season-years, the whole-farm yields were 77% of the yield in cages. An intuitive view of the two different pasture growth techniques is that the whole-farm growth represents the “capture” of the latent growth indicated from cage yields and is the consequence of management. Whole-farm

Table 1 Annual yields (t DM/ha) for cage or whole-farm pasture growth assessment.

	Cage yield	Whole-farm yield	SEM Cage	SEM WF	n
All Data	14.8	11.4	0.1	0.1	135
Regions					
Northland	14.5	10.9	0.2	0.1	90
Bay of Plenty	15.5	12.3	0.3	0.2	34
Waikato	15.9	13.3	0.4	0.5	11
Northland soils (non-irrigated)					
Volcanic	15.7	11.2	0.4	0.3	15
Alluvial	14.4	11.2	0.3	0.4	18
Gumland/Limestone	13.2	10.3	0.5	0.4	15
Hilly/Nth YBE	13.1	10.0	0.7	0.4	12
Irrigated farms					
Non-irrigated cage site	13.9		0.7		
Irrigated	16.6	11.5	0.5	0.6	12

yields were within 10% of the cages yields in 12 of all season-years, and, apart from the presence of the Ruakura data in this small group, only Northland farmers were in this group and 3 in particular. These farmers could be classed as the best pasture managers. Thirty season-years provided whole-farm yields less than 70% of cage yields, indicating poorer pasture management. Some farms were consistently present in this group and had the following features: irrigated, difficult soils, large herds, presence of kikuyu- or cocksfoot-dominant pastures. Apart from one season-year, no Bay of Plenty farm had above 90% or below 70% of whole-farm yield as a proportion of cage yield. This work has tended to indicate that excellent pasture management can be a localised, tuning process, and that considerable opportunity exists for its improvement on the dairy farms of the northern regions.

Cage yields in excess of 18 t DM/ha/year occurred in 9 season-years, all on different farms. Apart from 3 irrigated farms, no pattern could be deduced from these season-sites. These high yields, while rare, are only 60% of the estimated potential yield of these pastures (Piggot *et al.* 1986). Whole-farm yields below 9 t DM/ha/year occurred in 7 season-years, all on Northland rolling or hilly farms. Also, these low yields occurred in almost all years, suggesting that blaming the climate for poor pasture growth is only part of the “no grass” syndrome.

The differences between the regional means presented in Table 1 are unsurprising, as are the soil type differences from the Northland data. The Northland soils are often claimed to be uniformly poor, but the best Northland soil (volcanic) compares favourably with the Waikato and Bay of Plenty in cage yields. This

feature is relevant when attempting to benchmark the farm performance of Northland compared with Waikato systems, particularly the research work at Ruakura. Despite the increase in cage yield in response to irrigation, only a minor advantage in whole-farm yield could be detected compared with the regional means (Table 1). (All bar one of the irrigated farms was in Northland.)

Seasonal pattern

The difference between cage and whole-farm data was greatest in September (whole-farm 72% of cage yield) and then from January through to May (whole-farm growth averaging 72% of cage yields) (Figure 1). While individual farm data generally has a more variable pattern than Figure 1 data, the September effect is probably dominated by an accumulated pasture damage effect, a consequence of grazing wet soils in early spring. The cause of the summer and autumn effect is not as obvious.

Much of the difference between potential and actual pasture production on farms is frequently termed “waste” by commentators and is considered a deficiency in pasture utilisation. Some of the consequences of the seasonal growth differences between cage and whole-farm data mean that on a whole-farm basis the expected growth simply did not happen.

Farm indices

The reason for developing the whole-farm technique was to directly assist farm management. For example the key farm indices of stocking rate and calving date can be derived from such data as Figure 1. If Figure 1 represented an individual farm, at 3 cows per ha sufficient growth on the whole-farm for peak milk production would not occur until October, necessitating an August calving. Use of the cage data would provide unrealistic expectations of earlier calving at higher stocking rates.

The impact of the differences between farms is illustrated in Figure 2 which compares farms where whole-farm growth was above 14 t DM/ha/year (the high yielding curve which represents 14.4 t DM/ha), with hilly or rolling farms in Northland where annual yield of the whole-farm was less than 10 t DM/ha (the

Figure 1 Daily growth (kg DM/ha) for each month averaged over all data.

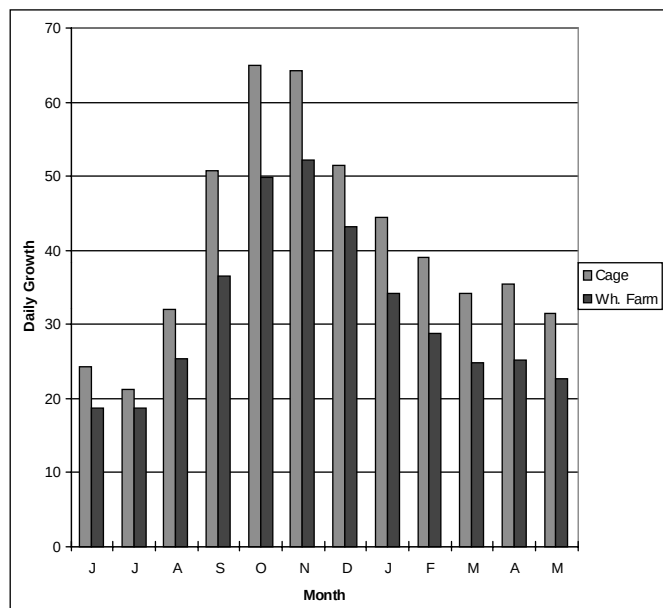
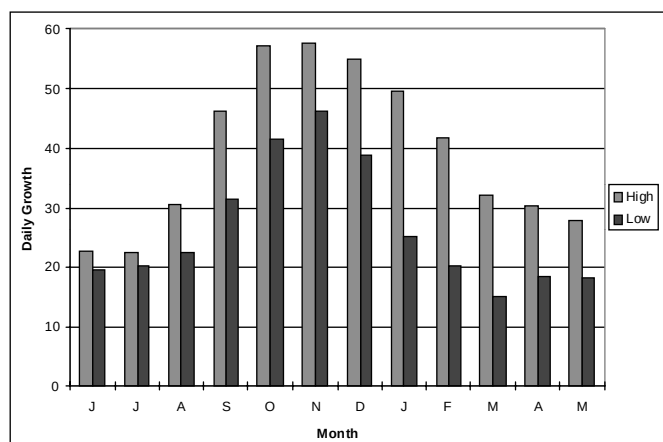


Figure 2 Daily growth (kg DM/ha) for each month for whole-farm assessment of high- and low- yielding farms.



low yielding curve which represents 9.6 t DM/ha). Ten farms were averaged from the high group including farms from all regions. Eight farms were selected for the low group for all years excluding the exceptionally poor 1994 (winter-spring) growth year. While the farms with the high yielding curve could comfortably manage 3–4 cows/ha for a full lactation, the low yielding farms present a greater challenge particularly when the drop off in summer growth is normally accompanied by a severe fall in feed value.

Farm comparisons

Farms can be paired for comparison of management effects (Table 2). In the first example, using adjacent farms in the Bay of Plenty in 1992, the hypothesis was examined that farms with "good" or conventional grazing control would have greater pasture and milk productivity. In this comparison the laxly grazed farm had a mean farm cover, averaged over monthly visits, of 2700 kg DM/ha versus 2300 on the conventionally grazed farm. But the laxly grazed farm tended to have higher pasture yields; and produced 1200 kg milksolids/ha compared with 1100 on the conventional farm (although the milksolids advantage was influenced by greater supplementary feeding on the high cover farm). Both farms were stocked at 3.1 cows/ha.

Table 2 Annual yields (t DM/ha) of adjacent farms of comparative interest.

	Cage Yield	Whole-farm Yield
Different farm cover		
Normal cover	16.9	13.3
High cover	18.9	13.5
Different base grasses		
Ryegrass	16.9	11.7
Cocksfoot	17.0	11.1
Kikuyu grass	15.8	10.7
Irrigation		
Not Irrigated	12.6	10.4
Irrigated	18.0	13.7

In the second example, adjacent farms north of Dargaville with different base grasses in the pasture were compared for 1992 and 1993. The district has a dry coastal climate and the granular clay soil tends to be drought prone. The hypothesis was examined that drought-tolerant kikuyu grass and cocksfoot would out-perform ryegrass. Contrary to popular belief this was not so.

In the third example, from the Kerikeri district, the hypothesis that irrigation would promote exceptional growth was somewhat tempered. Irrigation increased yield by 42% in cages but only 31% on a whole-farm basis, supporting the equivalent finding in Table 1.

Such comparisons have limited scientific respectability because of the lack of replication. Farm comparisons are impossible to standardise but they have credibility within the farming community. Research administrators should note that, because farmers pay for the cost of farm visits and pasture measurements, replicated farms could be studied cheaply as a means of clearing up many facets of farm management evaluated

today so unconvincingly in plot experiments and computer simulations. Thomson *et al.* (1997) have used the example of the use of turnips to argue the same point.

Conclusions

A standardised measurement of pasture growth conducted on dairy farms in the northern regions of New Zealand in the past 6 years has shown that annual yield estimated by a cage technique, at 14.8 t DM/ha, was 30% higher than that estimated on a whole-farm basis. The relative differences were greatest in September and from January to May. The role of pasture management was illustrated by the observation that some farms, including No. 2 Dairy at Ruakura, were capable of producing whole-farm pasture yields within 10% of the cage or latent growth. The importance of local tuning of pasture management was underlined by the wide range in whole-farm yields, from 9 to 15 t DM/ha.

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