GROWTH AND UTILISATION OF FORAGE ON SUBTROPICAL DAIRY FARMS

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SUMMARY

With deregulation, the focus for dairy production in northern Australia has changed from cow production to improving efficiency to maintain profitability. This requires more effective production and utilisation of forage for greater cost efficiency. This paper summarises the growth of tropical and temperate grass pastures on dairy farms in 2 rainfall environments in south-east Queensland. Fertiliser and feed inputs and milk output were investigated, and forage utilised for milk production was calculated by the reverse application of feeding standards. Growth of tropical grass pastures in summer averaged 100 kg DM/ha/day, with greatest yields at recommended nitrogen inputs. Irrigated annual ryegrass pastures produced 40-50 kg DM/ha/day in winter and over 60 kg DM/ha/day in spring. West Moreton farms (800 mm rainfall) produced 7-10 t DM/ha/year from rain grown tropical grass. Corresponding yields for East Moreton farms (1000 mm rainfall) were 19 t DM/ha/year. Irrigated temperate pastures yielded up to 10 t DM/ha/season in both regions. Pasture utilisation ranged from 20-30% for tropical grass in summer to 70-80% for temperate pasture in winter. Cow requirements exceeded pasture growth in autumn, requiring summer pasture to be carried over. Farm productivity could be increased through improved management of tropical pasture.

Keywords: dairy production, tropical grass, pastures, growth, utilisation

INTRODUCTION

Dairy production systems in northern Australia are predominantly pasture based, with tropical grass in summer and annual irrigated temperate pastures (ryegrass/nitrogen or clover mixtures) used in winter (Ashwood *et al.* 1993). Forage yield and/or quality are often low during the transition periods between tropical and temperate forages, and with variable rainfall patterns, limited irrigation and limited areas suited to cropping, farmers adopt conservative stocking rates adjusted to the carrying capacity of the farm during these transitional phases (Cowan *et al.* 1998). Cow body condition is used to buffer variation in pasture yield and cows can show considerable change in condition from periods of high to low pasture availability. The net result is a low animal output per hectare associated with a low average utilisation, particularly of tropical pasture. This utilisation has been estimated at about 30% during active growth (Kerr *et al.* 1995). Excess pasture grown may be carried over and utilised later, but quality of the mature grass is low. This study was conducted to investigate pasture management and cow nutritional inputs to assess the level of farm produced forage utilised for milk production by dairy farms in south-east Queensland.

MATERIALS AND METHODS

The study was conducted between 1998 and 2000. Eight dairy farms were selected as groups of 4 in 2 geographic regions of south-east Queensland, (i) East Moreton (EM), north of Brisbane – coastal, ≥1000 mm rainfall, mild winters; (ii) West Moreton (WM), Ipswich - Boonah – sub-coastal, 800 mm rainfall, frequent frosts. Production systems were broadly similar, with tropical grass pastures in summer and irrigated annual temperate pastures used in winter-spring. Each farm was intensively monitored for pasture and forage productivity, feed and fertiliser inputs, and milk output, to investigate the integration of pasture and concentrate management.

Pasture and forage DM on offer to the milking herd at grazing were measured at 4-week intervals for all farms from autumn 1998 to spring 1999, by cutting ten 0.25 m^2 quadrats to grazing height from the next paddock of each forage to be grazed. Forages were cut to their expected minimum grazing height (tropical grass 3-7 cm, temperate pasture 3-5 cm, forage sorghum 7-10 cm, lablab 12-15 cm). Growth of tropical grass and temperate pastures was measured using exclosure cages (~4 cages per pasture type) in representative paddocks for each pasture. For each measurement, exclosure cages were shifted to a fresh site cut to minimum grazing height, to measure subsequent regrowth, with a single 0.25 m^2 quadrat sample harvested to grazing height from each cage every 4 weeks. Harvested samples were dried at 80^{o}C for 48 hours to determine growth and DM yield on offer. Nutrient content of pasture on offer was determined quarterly by chemical analysis for nitrogen, *in vitro* OM digestibility (IVOMD) and neutral detergent fibre. Metabolisable energy (ME) content was calculated as 0.15*IVOMD (MAFF 1975). Herd milk yield and composition was obtained from factory records. Diary records of cows milked allowed calculation of production/cow. In autumn 1999, cows in each herd were weighed on 1 occasion immediately after morning milking. For calculations, this was used as the average liveweight of cows in each herd.

Pasture utilised by each milking herd was calculated by reverse application of feed standards (NRC 2001), based on ME requirements for a herd's fat corrected milk production, liveweight and adjusted for a gain of 0.25 kg/cow/day, for pregnancy and to next calving for a year round calving herd. Exercise was not included. By applying standardised ME values (feed analyses, NRC 2001) to concentrates, conserved supplements and pastures allowing for seasonal and management differences (irrigated, rain grown), pasture DM intake requirements were calculated (monthly basis) for each farm. Utilisation was determined as the difference between requirement and feed available as either (i) pasture on offer or (ii) pasture growth each month (cages).

RESULTS

Farms varied in area, herd size, supplement input, fertiliser use and irrigation level, with similar diversity for each region. In each region, 2 farms had a high level of irrigation, with 1 of each using a low concentrate input (Table 1). Concentrate level was highest for East Moreton farms. Nitrogen (N) fertiliser use varied among farms and with pasture type, with irrigated ryegrass receiving 30-50 kg N/ha after each grazing (~300 kg N/season), but little N applied winter or summer to pastures with clover. For most farms, level and frequency of N used for tropical grass pastures (100-300 kg N/ha/year), with some areas unfertilised, were below the recommended 300 kg N/ha/year.

Table 1. Production, herd and pasture management details for 8 case study farms.

	East Moreton				West Moreton			
Farm	[t]D1[RG]	D2 [MI]	D3[I]	D4 [SI]	B1[RG]	B2[MI]	B3[RG]	B4[I]
Av. rainfall 1998-2000 (mm/year)	1288	1162	1227	1575	688	927	658	824
Av. no. cows milked	80	88	60	140	80	44	80	148
Milk (L/cow/year)	5945	5935	5205	5339	4352	5932	5676	4385
Farm stocking rate (cows/ha)	1.3	2.2	3.0	1.8	1.0	2.4	1.3	2.0
Winter forage area (ha)	8	14	15	13	15	8.4	14	34
Temperate pasture[I] stocking rate (cows/ha)	10	5	5	12	6	9.4	6	4
Concentrate (kg/cow/day)	8	9-10	3	7	5	5	5	3-4
Area unimproved (ha)	53	6	-	21	31	4	18	5

[t] Summer Pasture Irrigation: [I] Fully Irrigated [MI] Most Irrigated [SI] Limited Supplementary Irrigation [RG] Rain-grown

Rainfall in both regions was above average in 1999, but below average in 2000. East Moreton farms were based on tropical and temperate pastures with part of the tropical area oversown to annual ryegrass or ryegrass/clover mixtures with clover persisting through summer. Although 1 farm planted temperate pastures into tropical grass, West Moreton farms generally used ryegrass as a separate cultivated annual crop, with some using part of this area for summer forage crops. Crop or ryegrass surpluses, if available, were conserved. East Moreton farms did not practice forage conservation and reduced problems of surplus tropical grass by slashing to maintain a higher leaf content, or by applying less frequent fertiliser inputs to limit excess growth.

Effective growth of tropical grass commenced in spring in both regions (Figure 1), with earlier growth response and longer productive season of summer pastures for EM farms (EM Sept - May; WM Oct - April). With milder winters (EM), tropical grass particularly kikuyu, contributed to winter forage available for grazing. With fewer rainfall events and cold winters, rain grown tropical grass pastures on WM farms made negligible growth from April to September, and production was further restricted by periods of moisture stress in summer. Peak growth rates were similar for both regions and ranged from 80-140 kg DM/day with a median of 100 kg DM/day. Annual yields for rain grown tropical grass were 19 t DM/ha for EM farms and 7-10 t DM/ha for WM farms. Irrigated pastures yields for EM farms exceeded 20 t DM/ha/year, with greater total annual production for tropical grass pastures oversown with ryegrass during winter. Farm areas used by heifers and dry stock were unfertilised and accounted for up to 20 percent of the area of some farms.

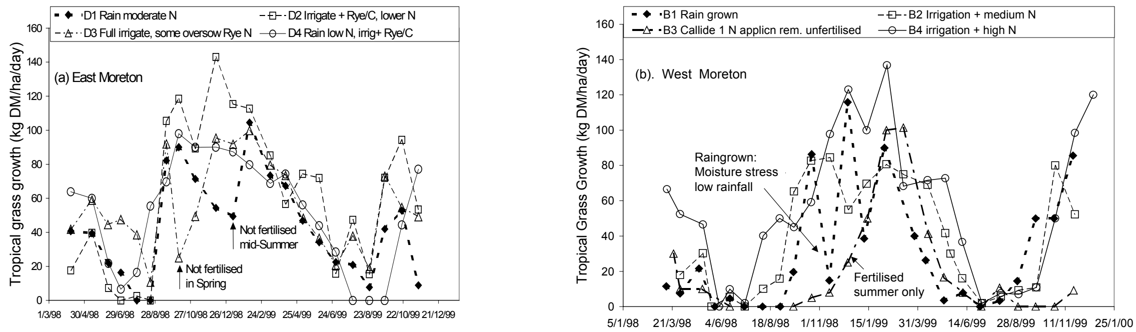

Figure 1. Tropical grass growth (kg/ha/day) on (a) East Moreton and (b) West Moreton farms.

Growth of irrigated temperate pasture was similar for both regions. Annual ryegrass and ryegrass/clover pastures produced 40-50 kg DM/day in winter, with growth increasing to 60 kg DM/day in September–October, for total yields of 7-10 t DM/ha. In oversown pastures on EM farms, the kikuyu or tropical grass component increased from September. West Moreton farms with limited irrigation fallowed pastures over summer or, where some irrigation was available, planted part to summer forage crops (sorghum, maize).

Apparent utilisation of forage (tropical and temperate) grown by 2 farms (low and high irrigation) in each region is presented as Figure 2 (EM) and Figure 3 (WM). All farms intensively managed temperate pasture with component stocking rates of 6-12 cows/ha, achieving high utilisation in winter. Some WM farms conserved spring surpluses as round bale silage.

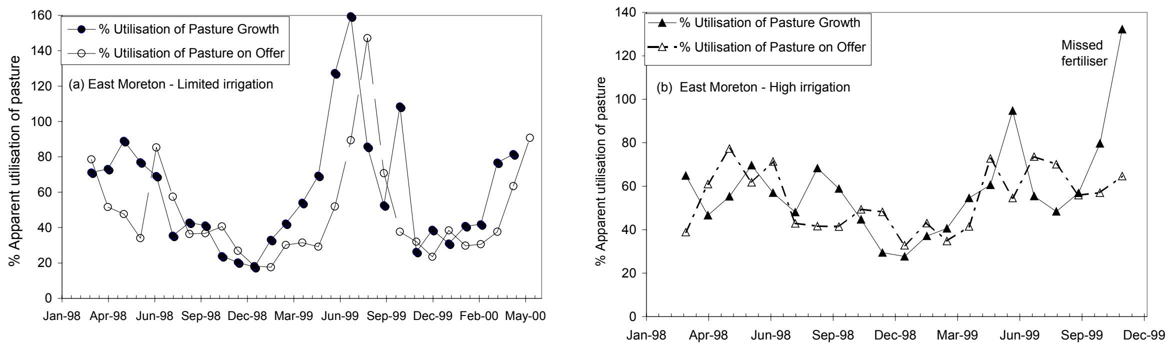

Figure 2. Apparent utilisation of pasture by East Moreton farms with (a) limited (b) high irrigation input.

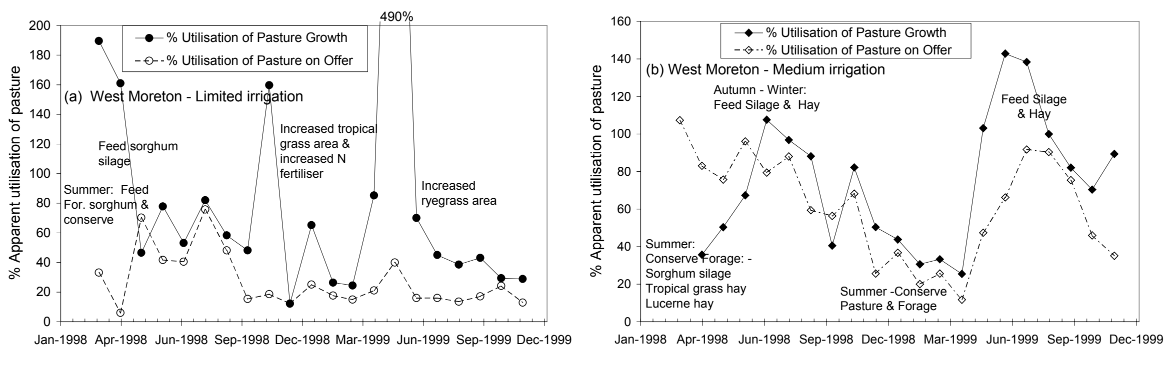

Figure 3. Apparent forage utilisation by West Moreton farms with (a) limited (b) medium irrigation input.

Apparent utilisation of tropical pasture DM on offer in summer was 20 - 30%, but utilisation of green leaf (25-50% of a sward) would have been about 50-70%. Cow requirements in autumn exceeded pasture growth at that time, with cows grazing feed carried over by conservative stocking in summer.

If cow requirements exceeded the measured feed on offer (to normal grazing height) in any season, farmers grazed pastures more heavily, used additional unfertilised areas and/or purchased extra feed, or animals utilised body condition. Farms with higher rainfall or irrigation managed tropical grass more intensively and achieved higher utilisation by (i) higher stocking, (ii) slashing in summer to increase leaf content and reduce DM on offer and/or (iii) including perennial temperates by oversowing with ryegrass/clover to increase forage quality with a summer clover component. One WM farm conserved surplus irrigated tropical grass in summer.

DISCUSSION

This project was conducted in the period leading up to deregulation of the dairy industry, with farm productivity and cost of production a major concern for all farms. Complex forage programs used to maintain continuity of feed for year round calving herds were contributing to inefficiencies in management and utilisation of feed resources. Major limiting factors to production were irrigation capacity and suitable areas for cultivation, so stocking pressure and utilisation of temperate pastures was high. Herd size was determined by a farm's ability to provide winter pasture, and tropical grass pastures were often under-utilised. Dry matter production of fertilised temperate and tropical pastures for these farms was similar to levels recorded by Lowe and Hamilton (1985), with much higher tropical grass DM yields achieved with irrigation, and by EM farms with more reliable moisture, than for rain grown pastures on WM farms.

Tropical grass pastures on most farms were not managed for high DM yield. Forage productivity in summer was less than potential and utilisation in summer was only 20-30% of pasture grown, similar to that estimated by Kerr *et al.* (1995), although some was used in autumn as pasture growth slowed. To avoid summer DM excesses, tropical grass pastures often were under fertilised, with significant areas receiving little or no fertiliser. As a consequence, risk of an autumn feed deficit was increased. Concentrate use was related more to milk price which, on some farms, contributed to inefficient utilisation of pasture. Farms with highest concentrate inputs also used less fertiliser on rain grown tropical grass.

Farms had the potential to increase productivity by improving management of tropical grass pastures. Increasing fertiliser to recommended levels and improving unfertilised areas could increase the amount of DM grown, allowing higher stocking rates. This study assisted management decisions through a more quantitative understanding of growth potential of pastures and cow requirements. Several farms adopted recommendations to increase fertiliser inputs, concurrently increasing herd size up to 15% in year 2000, for greater utilisation and milk output. Some reduced purchased concentrates to reduce milk production costs. Farm profitability may be improved by implementation of best practice fertiliser and nutritional management for increased farm production and cost reduction.

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